



September 2022

Final

## Mundaring Weir Rd - Road Safety Investigation

Prepared For: City of Kalamunda



## Final Report



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Project: Mundaring Weir Rd - Road Safety Investigation

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## **1 INTRODUCTION**

### **1.1 Commission**

DVC has been commissioned by the City of Kalamunda to carry out a safety investigation of Mundaring Weir Road between Railway Road and the City's northern boundary.

### **1.2 Scope of Work**

The following summary of the scope of work was provided by the City:-

1. Undertake a Road Safety Investigation (RSI);
2. Detail at a schematic level, treatments needed to address road safety risk for the road;
3. Report on the findings and recommendations.

Further details of the scope are included in the Specification document supplied by the City. In essence, these advised the following:-

The consultant is to assume that the road is to remain generally within its current alignment and uses. The City is not requiring proposals for large scale realignment or gradient changes.

For private accesses to the road, consider the safety perspective for the road users, however assessment is not required for the perspective of the private property owners.

The RSI shall be carried out as a corridor review and in accordance with the Austroads Safe Systems approach.

### **1.3 SITE VISITS**

Four site visits were carried out by Steve Yapp, Principal Consultant at DVC and an accredited Senior Road Safety Auditor. Daytime site visits were carried out on the 28<sup>th</sup> & 29<sup>th</sup> June 2022 and 7<sup>th</sup> July 2022, with a night time visit being carried out on 11<sup>th</sup> July 2022.

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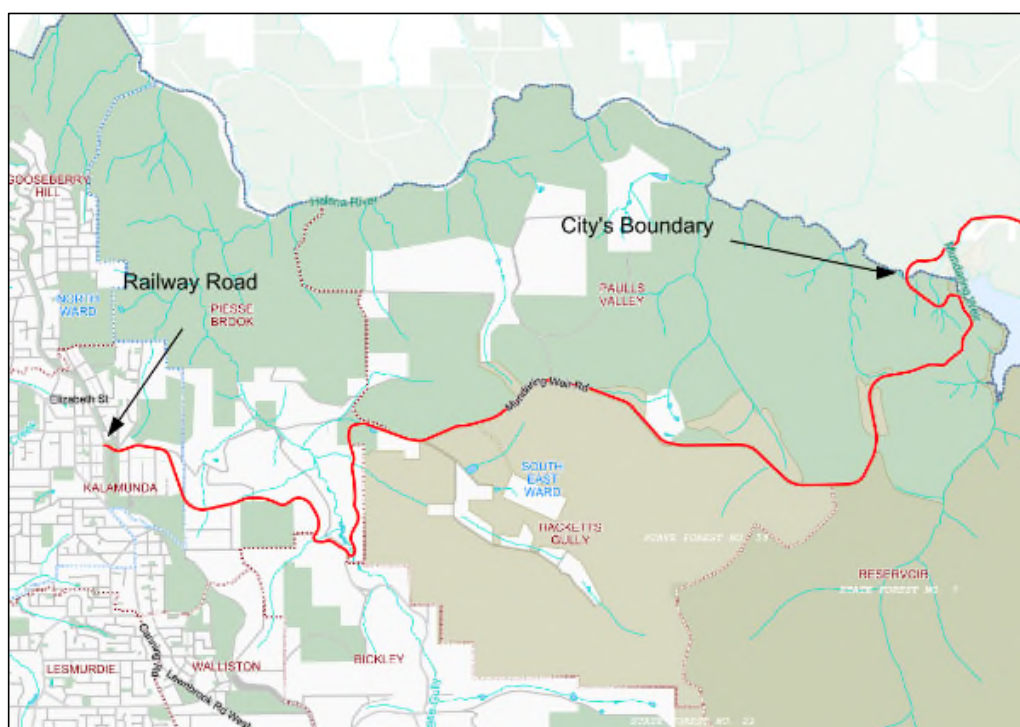
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## 2 BACKGROUND INFORMATION

### 2.1 Study Area Location

The study area consists of the sections of Mundaring Weir Road between Railway Road and the City's northern boundary. See **Figure 2.1**.



**Figure 2.1: General Study Location**

Source: City of Kalamunda

### 2.2 General

The sections of Mundaring Weir Road under investigation are all classified as Regional Distributor Roads under MRWA's Functional Road Hierarchy.

MRWA's definition of a Regional Distributor Road is:-

*"Roads that are not Primary Distributors but which link significant destinations and are designed for efficient movement of people and goods within and beyond regional areas. They are managed by local government".*

The hierarchy in the vicinity of the study area can be seen in **Figure 2.2**.

The posted speed limits, which vary between 60 km/h and 70 km/h along these sections of Mundaring Weir Road, can be seen in **Figure 2.3**.



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For the purposes of this investigation, the overall length of Mundaring Weir Road within the study area has been split into three mostly homogenous sections. These are:-

- ***Railway Road to Hinkler Road;***
- ***Hinkler Road to Fern Road; and***
- ***Fern Road to the northern City boundary.***

In general terms, the first section is primarily kerbed, has a footpath provided on the one side and its topography is relatively flat. The second is unkerbed, has no footpath and is typically more undulating in nature, with drop offs and trees along most of the length. The majority of the third section is similar in nature to the second, but has recently been improved, with edge lines, guideposts and sealed shoulders now installed.

### 2.3 Traffic Counts

Traffic counts in the vicinity of the study area were provided by the City. The information comes from counts carried out between 2019 and 2020, and includes both traffic counts and speed data.

The data shows that the annual average daily traffic (AADT) for Mundaring Weir Road, outside #108, was recorded in May 2019 as just under 1,800 vehicles per day (vpd). The speed limit along this section is 60 km/h, however just over 40% of drivers were recorded as exceeding this figure, with an 85%ile speed of around 65 km/h.

AADT for Mundaring Weir Road 300m north of King Road was recorded in May 2019 with around 2,200 vpd. The speed limit along this section is 60 km/h, however just over 54% of drivers were recorded as exceeding this figure, with an 85%ile speed of almost 68 km/h.

AADT for Mundaring Weir Road just west of Valley Road was recorded in May 2019 as just over 2,600 vpd. The speed limit along this section is 60 km/h. Approximately 36% of drivers were recorded as exceeding this figure, with an 85%ile speed of over 64 km/h.

AADT for Mundaring Weir Road 500m north west of Aldersyde Road was recorded in October 2020 as just over 1,500 vpd. The speed limit along this section is 60 km/h. Almost 45% of drivers were recorded as exceeding this figure, with an 85%ile speed of almost 66 km/h.

AADT for Mundaring Weir Road just west of Fern Road was recorded in June 2020 as just under 1,650 vpd. The speed limit along this section is 60 km/h. Approximately 30% of drivers were recorded as exceeding this figure, with an 85%ile speed of over 63 km/h.

AADT for Mundaring Weir Road 200m east of Fern Road was recorded in June 2020 as almost 1,550 vpd. Although this location is still within the 60 km/h speed zone, over 85% of drivers were exceeding this figure. The 85%ile speed is recorded as being 76 km/h.



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No traffic data was available for the sections of Mundaring Weir Road, further east of Fern Road.

AADT for Mundaring Weir Road, near #370, was recorded in June 2020 as just under 1,700 vpd. However, this location appears to be outside the study area.

The complete count and speed data sets are attached in **Appendix A**.

## 2.4 Crash History

Crash data was extracted from the MRWA CrashMap database for Mundaring Weir Road between its intersections with Railway Road and the City's northern boundary, for the latest 5 year reporting period of January 2017 to December 2021.

This data showed a total of 39 reported crashes, three of which involved a fatality. Eleven crashes resulted in a hospital visit, while 3 required medical attention. The majority of crashes occurred during daylight hours, and in dry conditions.

It is noted that the proportion of crashes resulting in KSI severity is very high compared to the network average. This is most likely due to a number of factors, including the vertical and horizontal alignment of the road, the unforgiving roadside environment and the high number of motorcyclists using the road.

There were seven head on crashes, four crashes involving a right turn and four rear end crashes.

There were 15 crashes described as 'Hit Object'. Three of these resulted from vehicles swerving to avoid animals. A further two crashes were described as 'Hit Animal' (kangaroos).

Three of the crashes involved bicycles, two of which were out of control. The third involved a car turning right. The majority of crashes involving motorcycles involved loss of control, mostly on left hand bends.

Details of the crashes can be found in **Appendix A**.

## 2.5 RAV Network

None of the sections of Mundaring Weir Road included in the study are designated as Restricted Access Vehicle Network (RAV) routes. See **Figure 2.4**.

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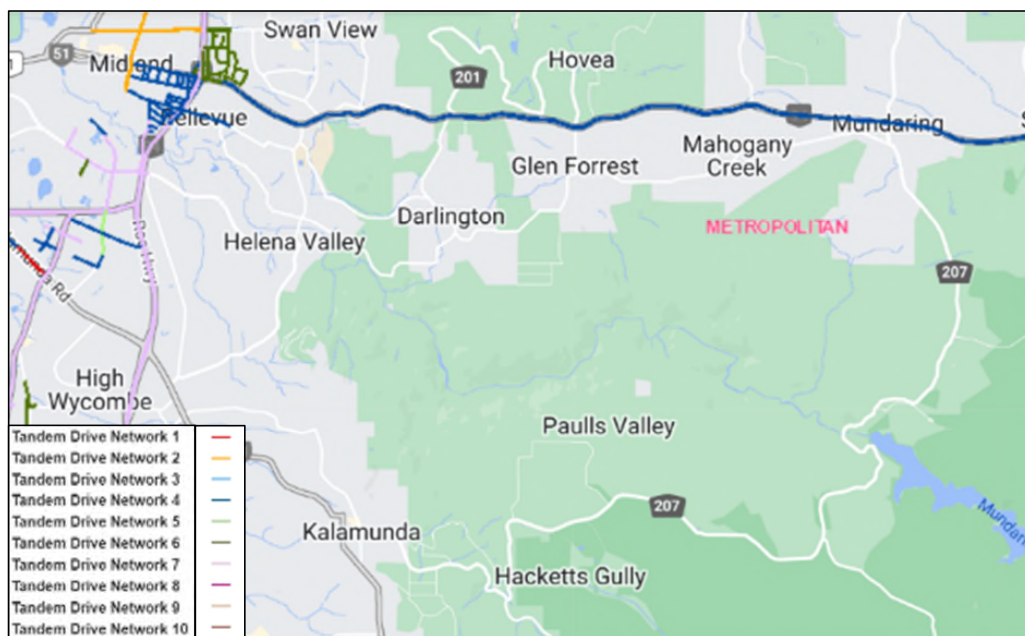


Figure 2.4: MRWA's RAV Network in the vicinity of the study area

## 2.6 Public Transport

There are no bus routes indicated along Mundaring Weir Road on the Transperth website.

## 2.7 Constraints

There are numerous constraints along these sections of Mundaring Weir Road in terms of carrying out widening or other improvements to the road. These include the presence of various services, both underground and above ground, as well as property boundaries and physical features.

In terms of making safety improvements to the road, these constraints will have a variety of effects:-

### ➤ Property boundaries / road reserve limits

The constrained width of the existing road reserve in some locations may limit the scope of some widening or realignment options, without the need to resume land, potentially at significant cost;

### ➤ Services

There may be significant costs attached to the relocation or protection of both underground and aerial services, if required.

### ➤ Roadside issues

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The main physical roadside constraints, other than services, are associated with non-frangible items such as trees, and steep batters in the clear zones, where the road is either in cutting or on an embankment. Whilst road users can be protected from trees by road safety barriers in some instances, removal can be problematic. The presence of drop offs and embankments can be addressed if widening of the road is required, but will clearly impact costs.

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### 3 SAFETY INVESTIGATION

#### 3.1 Adequacy of existing carriageway

Generally, the sections of Mundaring Weir Road under consideration are constructed with a single lane in each direction, of varying width. Some sections are kerbed, some have edge lines and sealed shoulders, and others have gravel shoulders. The geometry of the road fluctuates, with numerous horizontal and vertical curves limiting visibility to various extents.

The following paragraphs discuss the adequacy of the existing carriageway in relation to capacity and geometry for each of the sections of Mundaring Weir Road within the study area.

##### 3.1.1 General Capacity

Austroads Guide to Traffic Management Part 3 Traffic Studies and Analysis states that *'the Highway Capacity Manual (2016) indicates that the capacity of a two lane highway is 1,700 pc/h for each direction and is nearly independent of the directional distribution of traffic. For extended lengths of two-lane highway, the capacity will not exceed 3,200 pc/h for both directions of travel combined.'*

Maximum daily flows along the sections of Mundaring Weir Road under consideration are in the order of 1,500 to 3,000 vpd. Even after taking into account factors such as the percentage of Heavy Vehicles, limited lane widths, limited shoulder widths and sections with limited sight distance, it can be reasonably assumed that the traffic flows currently using this section of Mundaring Weir Road are generally well within the theoretical capacity of the road.

##### 3.1.2 Horizontal Curves

A desktop estimation of the radii of the curves along Mundaring Weir Road was undertaken and reference made to Austroads Guide to Road Design Part 3 Geometric Design Table 3.3 Section Operating Speeds, which correlates radii with section operating speed.

The horizontal curves have been assessed to determine whether their maximum desirable operating speeds are higher than the relevant posted speed limit. Where this is the case, drivers should be able to negotiate the curves safely if complying with the speed limit.

Nonetheless, under the safe systems approach, there is a need to consider whether drivers can safely recover should they leave the carriageway, providing them with a clear zone where possible.

##### **Railway Road to Hinkler Road**

The posted speed limit along this section of Mundaring Weir Road is 60 km/h.

All of the horizontal curves along this section have been assessed as being acceptable in terms of their maximum desirable operating speeds being higher than the relevant posted speed limit.

Typical horizontal curves along this section can be seen in **Photos 1 to 5**.



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**Photo 1: Bends on approach to the Railway Road roundabout, looking west.**



**Photo 2: Motorcycle approaching bend just west of Schmitt Road.**



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**Photo 3: The bend near Hummerston Road lies within the 60 km/h speed limit zone.**



**Photo 4: Bend in Mundaring Weir Road, east of King Road, looking west**

### **Croxton Road to Fern Road**

Whilst there are a number of significant horizontal curves along this section, the majority of these have been assessed as being acceptable in terms of their maximum desirable operating speeds being higher than the relevant posted speed limit. Thus, drivers should be able to negotiate the curves safely if



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complying with the speed limit. Typical horizontal curves along this section can be seen in **Photos 6 to 10**.



**Photo 5: Curves on Mundaring Weir Road between Croxton Road and Hinkler Road, looking west.**



**Photo 6: Typical s-bends within this section of Mundaring Weir Road, between Croxton Road and Aldersyde Road.**



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**Photo 7: Typical bend within this section, equipped with safety fencing, west of Aldersyde Road.**



**Photo 8: Motorcyclists enjoying the sweeping curves of Mundaring Weir Road, north of Aldersyde Road.**



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**Photo 9: Curves over the bridge near Chalet Rigi.**



**Photo 10: Motorcyclist negotiating the bend just west of Fern Road.**

The exceptions to the above include the sharp bend at Chainage 3400, just northwest of the northern Aldersyde Road intersection. This bend is estimated to have a radius of around 35m and a corresponding operating speed of 50 km/h. However, advisory 40km/h signs are already installed on both approaches. See **Photos 11 to 12a**.

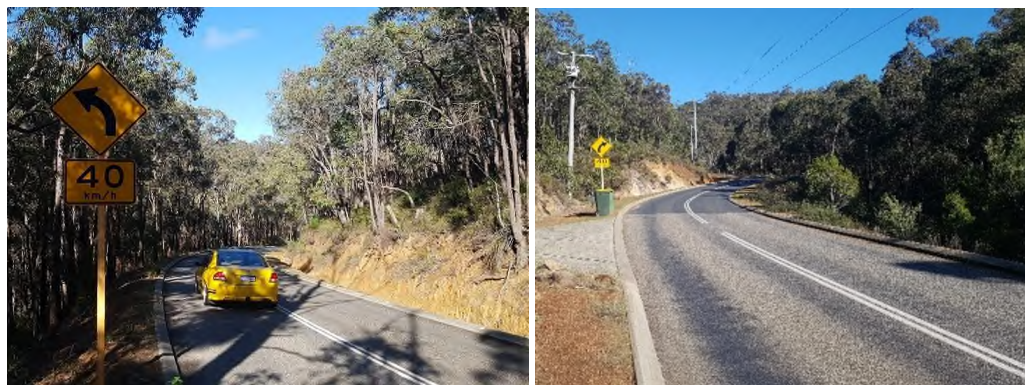


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Photo 11: This bend has a radius of around 55m.



Photos 12 & 12a: Advisory speed signs are already installed.

Also located within this section is the sharp curve at Chainage 3900, adjacent the southern Aldersyde Road intersection. This is estimated to have a radius of only 35m, and therefore requires a maximum operating speed of 30 km/h.

As can be seen in **Photos 13 to 14a**, advisory speed signs are already installed on both approaches to this location.



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Photo 13: This bend has a radius of approximately 35m.



Photos 14 & 14a: Advisory speed signs installed on both approaches.

### **Fern Road to Northern City Boundary**

Whilst there are a number of significant horizontal curves along this section, the majority of these are longer, sweeping curves, with larger radii and have been assessed as being acceptable in terms of their maximum desirable operating speeds being higher than the relevant posted speed limit.

For the bulk of this section, the posted speed limit is 70 km/h.

See **Photos 15 to 18**.



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**Photo 15: Sharp bend just west of Bahen Road intersection.**



**Photo 16: Horizontal and vertical curves between Paulls Valley Road and Asher Road intersections.**



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Photo 17: Bend to the west of Lockwood Road.



Photo 18: S-bends near Reservoir Road.

The exceptions to the above include the two sharp bends near the car park at the southern end of Mundaring Weir, chainage 14950 to 15150. These bends have been estimated to have radii of approximately 45m, giving a maximum operating speed of around 50 km/h.

Thus, despite the posted speed limit through this section being only 60 km/h, these curves do not comply. However, both curves currently have advisory speed limit signs installed. See **Photos 19 & 20**.



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**Photo 19: Sharp left hand bend adjacent Mundaring Weir car park.**

It is noted from the crash history that there have been four (4) head on crashes on the bend in **Photo 20**. Two of these crashes involved a motorcyclist and one a cyclist. With the exception of the crash involving a bicycle, the other three resulted from a westbound vehicle (2 x motorcycles, 1 x unknown) losing control and running wide into an oncoming vehicle.

All four crashes occurred during the day, in dry conditions. It is not known when the advisory speed limit signs were installed, but they appear new.



**Photo 20: Both curves currently have advisory speed limit signs.**

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### 3.2 Review of intersection connections

This section identifies the various intersections along Mundaring Weir Road, with a brief description of any immediate safety issues at each. Further examination of these issues can be found in **Section 3.4.** whilst facilities for cyclists and pedestrians are described in **Section 3.3.**

#### 3.2.1 *Railway Road to Hinkler Road*

The main intersections along this section of Mundaring Weir Road are with:-

- Schmitt Road;
- Crescent Road;
- Valley Road;
- Hummerston Road;
- Roach Road;
- King Road; and
- Hinkler Road.

#### **Schmitt Road**

Schmitt Road connects Mundaring Weir Road to Canning Road, via Collins Road, and provides access to a number of residential properties.

The side road at this intersection approaches from the south on a significant downhill gradient. There is an existing hazard board opposite the approach, but no Give Way (or Stop) signs or line marking. See **Photo 21.**



**Photo 21: T-intersection of Schmitt Road with Mundaring Weir Road.**



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There is a short section of W-beam opposite the side road, ostensibly to prevent overshoots from the side road dropping down the embankment. Typically, W-beam is not designed to withstand such impacts. It should also be noted that the barrier as installed does not cover the length of need regarding either the embankment or the power pole, does not meet the minimum effective length requirement of 28m and has non-crashworthy end terminations. See **Photo 22**.



**Photo 22: Hazard board, but no Give Way lines or signs. Note unsuitable safety fence.**

**Crescent Road**



**Photo 23: T-intersection of Crescent Road with Mundaring Weir Road.**



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Crescent Road's primary purpose is to provide access to Jorgensen Park and Kalamunda Community Centre, and meets Mundaring Weir Road in a T-intersection, with the side road approaching from the north on an uphill gradient.

The side road has Give Way and centre line markings, but no Give Way sign or hazard board. However, due to the acute angle of approach to Mundaring Weir Road, an advance warning sign on Crescent Road for the junction ahead would be more suitable and recommended.

See **Photo 23**.

### **Valley Road**

Valley Road meets Mundaring Weir Road in a T-intersection, and provides access to residential properties to the south. The intersection is equipped with Give Way and centre lines, a Give Way sign and a hazard board.

See **Photo 24**.



**Photo 24: T-intersection of Valley Road with Mundaring Weir Road.**

There is also a convex mirror installed, to aid with visibility, probably due to the presence of three large trees in the verge.

These trees are located in the visibility splay for vehicles turning out of the side road, and interfere significantly with sight lines to the right.

See **Photo 25**.



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**Photo 25:** Large trees in close proximity may limit visibility to the east.

### **Hummerston Road**

Hummerston Road provides access to large rural properties to the north of Mundaring Weir Road. It forms an alternative link through to Fern Road, whilst also intersecting with Roach Road, Croxton Road and Aldersyde Road. Its intersection with Mundaring Weir Road is located on the outside of a bend. See **Photo 26**.



**Photo 26:** T-intersection of Hummerston Road with Mundaring Weir Road.



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Approaching Mundaring Weir Road on an uphill gradient, Hummerston Road has Stop signs and lines, but no hazard board. See **Photo 27**.



**Photo 27: Hummerston Road approach to Mundaring Weir Road.**

### **Roach Road**

The T-intersection with Roach Road is priority controlled, but has no signs or line markings on approach. Visibility is good from the side road in both directions along Mundaring Weir Road. See **Photo 28**.



**Photo 28: T-intersection of Roach Road with Mundaring Weir Road.**



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### **King Road**

The geometry of the intersection with King Road is not ideal. The side road approaches at an acute angle, before swinging down and right to meet the through road at 90°. However, overgrown verge vegetation limits visibility. The intersection has a hazard board opposite the side road, as well as for the change in alignment on approach, but no Give Way or Stop signs or lines. See **Photos 29 & 30**.



**Photo 29: T-intersection of King Road with Mundaring Weir Road.**



**Photo 30: Side road approach has no Give Way signs or lines.**



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### **Hinkler Road**

Visibility from Hinkler Road is limited by the road alignment to the right and roadside vegetation, particularly to the left. See **Photos 31 & 32**.



**Photo 31: T-intersection of Hinkler Road with Mundaring Weir Road. Visibility to the right is good.**



**Photo 32: Visibility to the left is compromised by verge trees.**



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### 3.2.2 *Hinkler Road to Fern Road*

The main intersections along this section of Mundaring Weir Road are with:-

- Croxton Road;
- Aldersyde Road (2); and
- Fern Road.

#### **Croxton Road**

The intersection with Croxton Road has no signs or lines installed. Visibility is limited in both directions due to the horizontal alignment of Mundaring Weir Road. See **Photos 33 to 34a**.



**Photo 33: T-intersection with Croxton Road with Mundaring Weir Road.**



**Photos 34 & 34a: Visibility is limited in both directions by bends in the through road.**

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### **Aldersyde Road (N & S)**

Aldersyde Road intersects Mundaring Weir Road in a staggered T-intersection, with the two side roads separated by some 100m.

The northern section of Aldersyde Road intersects Mundaring Weir Road, on an uphill gradient, in an acute Y-intersection layout, as seen in **Photos 35 & 35a**.



**Photos 35 & 35a: Northern of the two Aldersyde Road connections forms an acute Y-intersection.**

Visibility is limited in either direction from the side road, due to the horizontal and vertical alignments of Mundaring Weir Road. This is exacerbated by roadside vegetation.

See **Photos 36 & 36a**.



**Photos 36 & 36a: Visibility is limited in both directions.**

The southern Aldersyde Road intersection meets Mundaring Weir Road on the outside of a sharp bend, as shown in **Photo 37**. However, visibility is still compromised in both directions by the alignment of the road. See **Photos 38 & 38a**.

W-beam safety fence has been installed on the inside of the bend, but is very close to the kerb line. The fencing has been struck multiple times, as can be seen in **Photo 39**.



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**Photo 37: Southern of the two Aldersyde Road intersections.**



**Photos 38 & 38a: Visibility from the side road is limited in both directions.**



**Photo 39: Safety barrier is very close to kerb line and has been struck several times.**



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### **Fern Road**

Fern Road forms a T-intersection with Mundaring Weir Road, located on a short straight between two sweeping bends. Visibility is limited to some extent to the left by the presence of a disused bus shelter, and to the right by a horizontal curve. The intersection has no Give Way lines or signs, no hazard board and a non-standard section of edge line. See **Photos 40 to 41a**.



**Photo 40: Fern Road intersection, with non-standard edge line marking.**



**Photo 41 & 41a: Visibility is limited in either direction.**

### **3.2.3 Fern Road to Northern City Boundary**

The main intersections along this section of Mundaring Weir Road are those with:-

- Bahen Road;
- Paulls Valley Road;
- Asher Road;
- Gunjin Road;





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- Lockwood Road;
- Little Oven Road;
- Ashendon Road;
- S Ledge Road; and
- Reservoir Road.

The road has been recently widened, along the bulk of this section, with sealed shoulders, edge lines and guide posts being installed. Side road intersections have been provided with kerbs, but there is evidence that additional signing and lining is yet to be completed by MRWA.

### **Bahen Road**

The intersection of Mundaring Weir Road with Bahen Road is a T-intersection. It has no Give Way signs or lines and no hazard board opposite. Visibility is limited in both directions by horizontal and vertical alignment issues. See **Photos 42 to 43a**.



**Photo 42: The intersection of Mundaring Weir Road with Bahen Road is a T-intersection.**



**Photos 43 & 43a: Visibility is limited in both directions.**



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### **Paulls Valley Road**

The intersection of Mundaring Weir Road with Paulls Valley Road is a T-intersection. It has no Give Way signs or lines and no hazard board opposite. However, it appears from markings and other evidence on site that upgrades to this intersection have yet to be completed. Visibility is limited in both directions by horizontal and vertical alignment issues. See **Photos 44 to 45a**.



**Photo 44:** Visibility to the right from the Paulls Valley Road intersection is limited by a horizontal curve.



**Photos 45 & 45a:** Upgrades may still be incomplete.



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### **Asher Road**

The intersection of Asher Road has a hazard board, but no Give Way signs or lines. The radii have been kerbed. Visibility is reasonable. See **Photo 46**.



**Photo 46: Intersection with Asher Road.**

### **Gunjin Road**

Gunjin Road has been sealed for a short distance back from Mundaring Weir Road. Similarly to other nearby intersections, it has kerbed radii but no signs or lines. See **Photo 47**.



**Photo 47: Intersection with Gunjin Road.**

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### **Lockwood Road**

The Lockwood Road intersection has no Give Way signs or lines, but does have a damaged Hazard board which is, in any case, incorrect for its location. There is also a significant amount of loose material being dragged onto the through road at the intersection. This may present a hazard to road users, especially bicycles and motor cycles. See **Photos 48 to 49a**.



**Photo 48: Lockwood Road intersection.**



**Photos 49 & 49a: Loose material being dragged onto the carriageway and a damaged (incorrect) hazard board.**

### **Little Oven Road**

Little Oven Road is a very minor, unsealed road. As can be seen in **Photo 50**, the side road approach has not been sealed, and even has a guidepost installed within the intersection. There are no signs or line markings.



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**Photo 50: Little Oven Road is unsealed.**

### **Ashendon Road**

Ashendon Road is a very minor, unsealed road. As can be seen in **Photo 51**, the side road approach has not been sealed. There are no signs or line markings.



**Photo 51: Ashendon Road approach is unsealed.**



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### **S Ledge Road**

S Ledge Road is a very minor, poorly sealed road. As can be seen in **Photo 52**, the side road approach has not been properly sealed, and has various pot holes. There are no signs or line markings, and the intersection radii have not been kerbed. See **Photos 53 & 53a**.



**Photo 52: S Ledge Road intersection.**



**Photos 53 & 53a: The side road radii are not kerbed.**

### **Reservoir Road**

Reservoir Road is a very minor, poorly sealed road. As can be seen in **Photo 54**, the side road approaches at an acute angle and has not been properly sealed. The appropriate junction ahead sign should be installed on the approach to Mundaring Weir Road. There are no signs or line markings, and the intersection radii have not been kerbed.



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**Photo 54: Reservoir Road**

### 3.3 Property and Other Accesses

There are numerous property accesses along this length of road, varying from individual residential driveways to service roads and access roads to car parks and pumping facilities. The main accesses are discussed briefly in this section.

#### **Chalet Rigi**

Chalet Rigi lies just to the south of a series of significant S-bends. The property currently has two partly sealed accesses. A widened section of seal forms an unmarked, pseudo left turn lane. See **Photo 55**.







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**Photo 55:** The partly sealed accesses to the Chalet Rigi car parks are on the left. There is no edge line.

The lack of clear definition of the accesses or the edge of the carriageway is not ideal on the approach to these S-bends.

It is understood that an application has been received from the property owners to upgrade the facilities at Chalet Rigi, including a proposed slip lane and revised crossover. These are noted, but it is important that the access is well signed, and that the edge of the carriageway is well defined as a part of any upgrades, particularly at night.

### **Mundaring Weir Car Parks**

At the southern end of Mundaring Weir, there are two car park accesses, located between two significant horizontal curves. As the eastern access is located on the outside of the bend, visibility is reasonably good. See **Photos 56 & 56a**.



**Photos 56 & 56a:** Eastern Mundaring Weir car parking access.

However, visibility at the western car park access is limited by the bends. See **Photos 57 & 57a**.



**Photos 57 & 57a:** Visibility from the western Mundaring Weir car parking access.

It is noted that from the Crash History data, there have been four (4) head on crashes on the bend just west of the western car park access.

### **No. 1 Pump Station**

The access road to No 1 Pump Station is on a straight section of road, with reasonably good visibility. The access has a Stop sign and line. See **Photos 58 to 60**.

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**Photo 58: Access Road to No.1 Pump Station.**



**Photo 59 & 59a: Visibility from the No. 1 Pump Station access road.**



**Photo 60: The access is not kerbed, but does have a Stop sign and line.**



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### **Residential Accesses**

There are individual residential property accesses located all along the three of the sections of this road being investigated, with many of them having steep gradients and limited visibility.

Some have installed convex mirrors, to assist with visibility when turning out onto Mundaring Weir Road. However, the majority simply have to exercise caution whenever they enter or leave their driveways. A few examples are shown in **Photos 61 to 63**.



**Photo 61: Extremely steep unsealed property access with crossover.**



**Photo 62: Steep concrete driveway on inside of curve gives limited visibility.**



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**Photo 63:** Convex mirror installed to assist with visibility.

### 3.4 Adequacy of pedestrian and cycling facilities

Generally, there are very few existing facilities along the first two sections of Mundaring Weir Road (Railway to Hinkler and Hinkler to Fern) that have been specifically provided for cyclists. However, a significant proportion of the last section, (Fern to the northern Shire boundary) has recently been widened, and hard shoulders are available for cyclists to use from just east of Fern Road to just short of the car park at the southern end of Mundaring Weir.



**Photo 64:** It is not clear why the cyclist warning sign is required in this location.



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Where these sealed shoulders are present, this provides some limited additional road space for cyclists, allowing them to remain separated to some extent from through vehicular traffic, and thus reducing the incidence of drivers, particularly of large trucks, needing to follow much slower moving cyclists until a passing opportunity arises.

However, not only does the width of these sealed shoulders vary significantly along the road, but the surfacing also varies in its texture and 'rideability'. The presence of significant amounts of loose material, such as gravel, gumnuts and other general rural-road-detritus also lessens the attractiveness of these sealed shoulders for use by cyclists.

The following sections assess the adequacy of the existing pedestrian and cycling facilities along this road.

#### **3.4.1 Railway Road to Hinkler Road**

Whilst there is a footpath along this section, albeit on one side of the road only, it is not generally suitable for cyclists, and falls well below current design standards, in several regards.



**Photo 65: Cyclists have to use the traffic lanes, or a very poor standard footpath.**

There is also evidence that the opposite verge is regularly trafficked by pedestrians.

See **Photo 66**.

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**Photo 66:** Evidence of regular foot traffic along this verge.

The standard of pedestrian crossings is generally poor. Even at the Railway Road roundabout, TGSIs are either missing or poorly aligned. See **Photo 67**.



**Photo 67:** Tactile Ground Surface Indicators (TGSIs) are poorly aligned or missing.

Generally, the pedestrian crossings along this section of Mundaring Weir Road are well below current standards, as can be seen in the typical example shown in **Photo 68**.



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**Photo 68:** Typical pedestrian crossing, with ramps being well below current design standards.

The crossing opposite Hummerston Road is unsafe and should be removed / relocated.

The crossing is badly located, with poor visibility, the ramp is far too steep and there are no TGSIs. The ramps on the opposite side – one on each side of the Hummerston Road intersection – are well below standard, and would be impossible to identify for anyone who is visually impaired. See **Photos 69 & 70**.



**Photo 69:** This crossing opposite the Hummerston Road intersection is poorly designed and should be removed.



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**Photo 70:** The crossing is badly aligned, with ramps well below current standards, no TGSIs and limited visibility.

There are numerous trip hazards along this section of footpath. These range from badly fitted service lids to cracks caused by tree roots. Other obstacles observed on site included trees in close proximity to the path, overgrown verge vegetation, loose material and debris, and a trailer parked on the footpath.

See **Photos 71 to 75a**.



**Photo 71:** Trip hazard in footpath.



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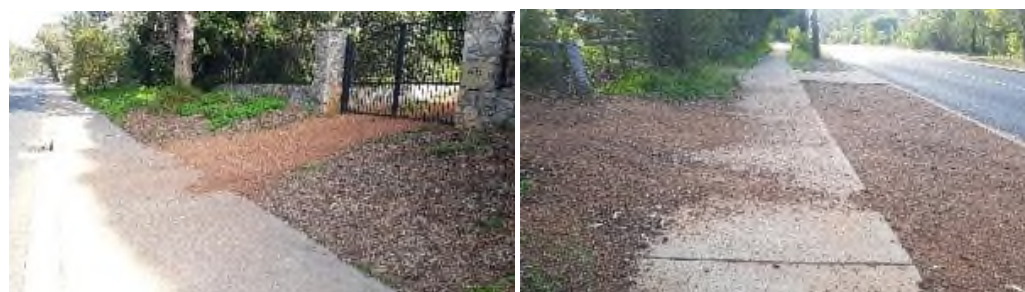
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**Photo 72: Significant trip hazard due to root damage.**



**Photo 73: This trailer appears to be parked on the footpath regularly.**



**Photos 74 & 74a: Loose material dragged onto footpath and road surface from unsealed driveways.**



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**Photos 75 & 75a: Footpaths obstructed by debris.**

In addition, there are a number of drainage grids that are very poorly designed in terms of cyclist safety. See **Photo 76**.



**Photo 76: Typical 'Cycle-unfriendly' drainage facility.**



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The footpath ends at the Hinkler Road intersection, with no continuation along either road.



**Photo 77:** The footpath terminates at this point, with no continuation along either road.

### 3.4.2 *Hinkler Road to Fern Road*

There are no on road cycle lanes, no hard shoulders and no footpaths along this section of Mundaring Weir Road. The road is kerbed between the Hinkler Road and southern Aldersyde Road intersections, giving no space for cyclists to manoeuvre when being overtaken. See **Photo 78**.



**Photo 78:** Any pedestrians have to walk on the verge.



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Again there are a number of drainage features that are unsafe for cyclists. See **Photos 79 & 79a**.



**Photos 79 & 79a:** These drainage designs present a hazard to cyclists.

Beyond Aldersyde Road, the road is mostly unkerbed, with unsealed shoulders and verges.



**Photo 80:** Only the occasional cyclist was seen using this section of the road.



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### 3.4.3 Fern Road to Northern City Boundary

There are no specific cycling or pedestrian facilities along this section of Mundaring Weir Road. The road has recently been widened along the majority of this section, with edge lines, guideposts and sealed hard shoulders. However, the width of the hard shoulder varies, and whilst in some areas it provides a reasonably safe place for cyclists to ride, in others it is either too narrow, or the surfacing of the shoulder is not conducive to safe cycling. See **Photos 81 and 81a**.



**Photos 81 & 81a: Hard shoulders vary in width and rideability. Note temporary reflector tabs on white lining.**

Towards the end of this section, near Mundaring Weir itself, the sealed shoulders are again absent.

## 3.5 Identification of Road Safety Issues

### 3.5.1 Railway Road to Hinkler Road

There is a drop off on the northern side of Mundaring Weir Road, opposite the Schmitt Road intersection. A short section of W-beam has been installed, but this is not an acceptable solution. See **Photos 79 & 80**.



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**Photo 82: Schmitt Road: No Give way signs or lines. Note unsuitable use of not-to-standard W-beam.**

Typically, W-beam is not intended to be used to withstand 90° impacts. The section as installed is also too short to provide effective protection from acute angle collisions, and has non-crashworthy end treatments.



**Photo 83: Barrier is too short, does not fully protect the power pole and has non-crashworthy end treatments.**

There are also a significant number of roadside hazards along this section of the road. These include power poles and trees located too close to the traffic lanes. See **Photos 84 & 84a**.



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**Photos 84 & 84a:** Roadside hazards for errant vehicles include non frangible power poles and trees.

There are a number of other hazards adjacent the carriageway on this stretch of Mundaring Weir Road, including root damaged kerbing and narrow parking bays. See **Photos 85 to 86a**.



**Photo 85:** Tree roots are beginning to lift and crack the kerbs.





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**Photos 86 & 86a:** Parking bays (possibly former bus embayments?) are unmarked, and not really wide enough.

The night audit revealed that not all of the signs are retro-reflective. See **Photo 87**.



**Photo 87:** One example of a number of sign faces that are worn and consequently no longer retro-reflective.

### 3.5.2 *Hinkler Road to Fern Road*

The western part of this section is kerbed, and has a centre line, but has no footpaths. Some of the s-bends west of the southern Aldersyde Road intersection have W-beam safety barriers installed, helping to reduce drivers' exposure to the many significant drop offs adjacent the road.

Whilst some of these embankments feature open, unrecoverable batter slopes, others are hidden by trees and bushes.

See **Photos 88 & 89**.



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**Photo 88: Unrecoverable batter with a significant drop off. Note service lid.**



**Photo 89: Another typical drop off along this section.**

Other issues include the presence of very old guideposts, cycle unfriendly drainage grids and non-crashworthy safety barrier end treatments.

See **Photos 90 to 92.**



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Photo 90: Very old guide post. Note reflectors mounted on kerbs. Photo 91: Non-cycle friendly drainage grid.



Photo 92: W-beam with a non-crashworthy termination treatment.

It was noted on site that a number of drivers tend to drive over the centreline of the road, especially when accelerating up hills. The introduction of audible lines may help to prevent this. See **Photo 93**.



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**Photo 93:** Numerous vehicles were observed cutting the curves and straddling the centreline.

Although the safety barriers do protect errant vehicles from some of the roadside hazards along this section of road, it can be seen in **Photos 94 & 95** that there are many more that remain exposed.



**Photo 94:** Although the safety barrier ends here, the roadside hazards do not.



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**Photo 95:** A large tree stands exposed just before the safety barrier commences.

The W-beam safety barriers lining the road through the curves near the southern Aldersyde Road intersection are mounted very close to the kerbs, and have been struck numerous times on both the outside and the inside of the bend. See **Photo 96**.



**Photo 96:** Damage to the safety fence near Aldersyde Road.

As well as trees, steep embankments and safety barriers, there are a number of other roadside hazards awaiting errant vehicles along this stretch. See **Photos 97 to 97f**.



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Photo 97 to 97f: Other roadside hazards include head walls, culverts and large rocks.



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### 3.5.3 Fern Road to Northern City Boundary

Although this section of road has largely been widened, with edge lines and sealed shoulders installed, there still remain a number of roadside hazards. These include large trees and concrete drainage culverts, especially along the section west of Bahen Road. See **Photos 98 & 98a**.



**Photos 98 & 98a: Roadside hazards**

As can be seen in **Photos 99 to 100**, a number of the new guideposts installed along this section are being struck by vehicles. It is not immediately clear why this would occur, but it may be reduced by the installation of audible edge lines.



**Photos 99 & 99a: Broken guide posts.**



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**Photo 100: Damaged Guidepost.**

One of the 60 km/h speed signs was seen lying down in the verge. This should be replaced. Another post had been sheared off. See **Photos 101 & 101a.**



**Photos 101 & 101a: Broken sign posts.**



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Outside the area recently widened, there are still a number of very old guideposts. See **Photo 103**.



**Photo 102: Old guidepost**

Generally, there is no street lighting installed along this section. Where the recent road widening works have been carried out, the new guideposts delineate the road much better, where installed, as do the RRPMS, however these are mostly temporary 'stick & stomps' and many are already missing.



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## 4 IMPROVEMENTS AND DESIGN CONCEPTS

The following paragraphs identify prior and potential improvements together with some initial outline design concepts needed to address the main safety issues identified within this investigation. These cover safety issues affecting all road users, but the development of each concept includes specific consideration of the existing and future safety of cyclists along this road.

The proposed improvements are split into those that are present throughout the study area, and result in a general concept, and more specific issues, grouped within the same road sections as before.

Concept plans for the main improvements can be found in the text or attached in **Appendix C and D**.

### 4.1 Prior Improvements

A number of safety improvements have been carried out over recent years. Some of these include:

- Widening and installation of W-beam safety barriers on the western bend between Croxton Road and Aldersyde Road, in the 2012/13 financial year;
- Minor widening from Fern Road to Aldersyde Road, in the 2013/14 financial year;
- Installation of W-beam safety barriers on the bend near Aldersyde Road on both sides of the road, in the 2014/15 financial year;
- Widening of the bridge, improvement of the geometry of the road and installation of new safety barriers near Chalet Rigi, in the 2018/19 financial year; and
- Seal and shoulder widening, clearing of vegetation, and providing improved line marking and signage from Fern Road to the City's boundary, in the 2018/19 and 2019/20 financial years.

It has been noted in the relevant sections above that some of the works between Fern Road and the northern boundary did not appear to have been completed at the time of the site visits. Mostly, the outstanding items appear to be tasks that MRWA would normally perform, including line marking, sign erection and RRPM installation.

### 4.2 On-Road Cycle Lanes – Assessment of Demand

Clearly, the sections of Mundaring Weir Road included in this study are not currently conducive to safe cycling or, in the most part, pedestrian use. The traffic lanes are narrow, much of the road is kerbed, and the verges and shoulders are not generally suitable for pedestrians or cyclists.

During the site visits, it was noted that the number of cyclists observed was very low. However this may increase on the weekends, or at other times of day, or year. On the other hand, the numbers may be low due to the perceived and actual safety issues of riding on this road in its current form. There may in fact be a latent demand, that could potentially be unlocked with suitable upgrades.

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It was also noted on site that the majority of cyclists that were observed appeared to be using Mundaring Weir Road in the manner of 'training'. This is confirmed within the City of Kalamunda's 2017 Bike Plan, which identifies Mundaring Weir Road as a potential 'Training Route'.

As a training route, it is likely that cyclists would prefer to ride 'on-road', and therefore separate off-road facilities are unlikely to be popular among this group. It is noted however that, along the majority of this road, this may prove prohibitively expensive, and/or potentially impractical.

Thus, the provision of on-road cycle lanes is not considered to be a priority upgrade at this time, and should only be considered appropriate for this road if and when sufficient demand is identified.

### **4.3 General Improvements**

The following sections provide an indication of general improvements that are not necessarily limited to specific locations, but rather should be investigated along the whole length of this road.

#### **4.3.1 Intersection Upgrade Strategy**

Although some intersection upgrades have already occurred within the widened section of road between Fern Road and Reservoir Road, the general standard of the intersections along this road is poor. The level of signage and line marking is inconsistent, and visibility at many of the intersections is below that required. In addition, the intersections with unsealed roads have different standards, whereby some have been sealed for a suitable distance back from the through road, where others have not.

Some priority issues identified at certain intersections have been addressed with specific recommendations in subsequent paragraphs, but there is also a general need to implement a strategy to commence bringing these intersections up to an acceptable standard in terms of signage, line marking, visibility and lighting. See also 4.3.3 & 4.3.5.

#### **4.3.2 Mid-block Visibility / Sight distance**

There are a number of areas throughout the three sections of Mundaring Weir Road where visibility along the road may not meet the requirements of applicable Austroads standards. In some cases, this is due to vertical curves, where significant civil works may be the only option to achieve the requirements for the existing speed environment. However, in other areas, where the issue is related to the horizontal alignment, it may be possible to provide significant improvements either through slight adjustments to the road alignment, or by the removal of roadside vegetation.

#### **4.3.3 Signage Strategy**

The existing signage provided along these sections of Mundaring Weir Road is inconsistent, with some essential warning signs missing. Some significant horizontal and vertical curves currently have little or no warning or delineation, whilst other existing signs are faded and no longer retro-reflective.



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Even along the recently widened section between Fern Road and the northern boundary, it appears that a significant number of planned new signs have not as yet been installed by MRWA.

As can be seen in the brief descriptions of issues at the various intersections, there is also a general inconsistency with signs and line marking. Many of the intersections have no Give Way (or Stop) signs or lines, hazard boards are missing and there are no intersection warning signs on the through road.

Further study will be required to identify which signs need to be removed, replaced, relocated or installed, in order to provide a consistent signing strategy for the road.

#### **4.3.4 Audible Edge and Centre Lines**

Audible edge lines can be very effective in encouraging drivers to remain within the traffic lanes, and should, as a priority, be installed where there are no kerbs or safety barriers. It appears from the damage to newly installed guideposts, and from observation on site, that some drivers do use the hard shoulders to 'straighten out' some of the curves, as well as crossing the centrelines, to enable them to travel at higher speeds. This is particularly noticeable with bends located on gradients.

The targeted introduction of both audible edge lining and audible centre lining should reduce the attractiveness of this practice, and thus reduce the likelihood of off road and head on crashes in these areas.

#### **4.3.5 Road side Hazards**

As detailed in the previous sections, there are numerous roadside features that may present a hazard to errant vehicles. These include trees, drop offs, rocks, drainage features etc.

Whilst it is not possible within this report to address the level of risk or preferred treatment to deal with these individually, some items of particular concern have been identified in the various sections. Generally, such items or features will need to be assessed for risk, and either removed or provided with protection.

For the more general items, such as trees and drop offs, these would most readily be treated with the provision of appropriate lengths of safety barrier.

#### **4.3.6 Drainage Grids**

A number of unsuitable drainage features were identified, at various locations, which, although designed to channel water flow into the kerbside gulleys, also present a significant hazard to cyclists and possibly motorcyclists. These should be replaced with gratings designed to meet current standards.

#### **4.3.7 Safety Barrier End Treatments**

A number of non-crashworthy end treatments were seen during the site visits. These should be replaced by treatments that comply with the latest standards.

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#### 4.3.8 *Street Lighting*

The standard of lighting along the sections of Mundaring Weir Road being investigated is inconsistent, and generally poor. The provision of lighting is limited, with illumination levels provided by the differing types of lighting also being inconsistent. See **Photos 103 & 104**.



Photo 103: Street lighting west of Valley Road, looking east.



Photo 104: Street light at Hinkler Road intersection.



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The existing street lighting should be catalogued, with current levels of illumination provision determined. A general upgrade programme should be implemented, to achieve the levels required by current standards.

#### **4.4 Specific Improvements - Railway Road to Hinkler Road**

##### **4.4.1 Footpath Upgrade**

The existing footpath along this section of Mundaring Weir Road falls well below current standards, as shown in **Sections 3.4.1 & 3.5.1** above. In its present form it is generally unsafe for pedestrians and unsuitable for cyclists.

Given the limited road space, and the kerbed nature of the road, there is little room for manoeuvre when vehicles, especially trucks, need to overtake on-road cyclists. In addition, this is the most densely populated section, resulting in higher pedestrian and cyclist traffic.

It is therefore recommended that the existing footpath through this section be upgraded to a 3m shared path, with suitable crossing points as required. The cost estimate has allowed for 1m widening of the path for the majority of its length (80% or 1,600m), with 20% (400m) assumed to be required to be new path.

##### **4.4.2 Safety Fence at Schmitt Road**

As detailed in section 3.2.1, the section of safety barrier currently installed opposite the Schmitt Road intersection has several safety issues, which should be addressed. The W-beam barrier should be lengthened to protect an errant vehicle, on Mundaring Weir Road, from the power pole and embankment. The non-crashworthy end treatments should also be upgraded to existing standards.

##### **4.4.3 Pedestrian Crossing opposite Hummerston Road**

As discussed in **section 3.4.1**, this crossing is unsafe, and should be removed and relocated.

#### **4.5 Specific Improvements - Hinkler Road to Fern Road**

##### **4.5.1 RRPMS, reflectors & guideposts**

This section of the road is kerbed from Hinkler Road right through to just north of the southern Aldersyde Road intersection. Some sections also have safety barriers installed. Despite this, many of the horizontal curves are currently poorly delineated, especially at night, which increases the risk of run-off-road and head on crashes.

Whilst there are some guideposts installed, these are inconsistent, with some missing, and others very old and no longer effective. The safety barriers do not generally have reflectors fitted.

Notwithstanding other recommended treatments, the night time delineation of this section should be improved by the installation of reflectors fitted to all safety barriers, guideposts being installed where



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there is no barrier, and RRPMs being installed down the centreline of the road through all significant bends.

#### **4.5.2 Safety Barriers**

The topography of this section does not generally lend itself to the provision of sealed shoulders and edge lines, with drop offs and embankments close to the road, as well as a large number of trees.

Additional sections of safety barrier should therefore be installed as required. The barriers should be fitted with reflectors.

Audible centrelines should also be considered through some of the curves or preferably along the full length of Mundaring Weir Road, to reduce the risk of head on crashes.

#### **4.5.3 Bridge near Chalet Rigi**

The bridge near Chalet Rigi has been widened and improved in recent years, with a better alignment and new safety barriers installed. This improves the safety of the road during daylight, but the lack of lighting, RRPMs or reflectors leave drivers with little delineation of the curves at night.

See **Photo 105**.

These issues need to be addressed, potentially with street lighting being installed, but as a minimum RRPMs should be installed along the centreline, and reflectors fitted at intervals along the safety barriers.



**Photo 105:** The alignment through the bridge is not well delineated at night.



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#### **4.6 Specific Improvements - Fern Road to Northern Boundary**

##### **4.6.1 Completion of earlier work, audible edge lines & centre lines**

Sealed shoulders, edge lines and guideposts have recently been installed on much of the Fern Road to northern boundary section. This assists with delineation of the horizontal curves through this section, particularly at night, and should reduce the risk of off road crashes. As noted previously, this work needs to be completed, with some line marking, sign installation and RRPM work still unfinished.

As the provision of fully compliant on road bicycle lanes does not currently appear to be justified, the sealed shoulders should provide some additional road space for cyclists. However, it is noted that the shoulders as constructed do not necessarily provide a safe environment for cyclists, and this has clearly not been the primary purpose of this improvement.

There is still a length of road, between the Reservoir Road intersection and the northern boundary, that has not been upgraded. Whilst there are some kerbs provided intermittently, this length would benefit from being upgraded to the same standard as the preceding stretch, with sealed shoulders, edge lines and guideposts.

Consideration should be given to introducing audible edge lines throughout this section, in conjunction with the existing and proposed sealed shoulders, as a means of further reducing the risk of off road crashes. Audible centrelines should also be considered through some of the curves, to reduce the risk of head on crashes.

##### **4.6.2 Bends near Mundaring Weir Car Parks**

As identified in **section 3.1.2**, there have been four head on collisions in this location, with three involving motorcyclists or cyclists. This is the only location throughout the study area where this type of crash pattern is clear and obvious, and indicates that there is a need for a specific treatment to help prevent these crashes from continuing to occur.

As the crashes resulted in hospital visits, medical treatment and property damage only, no Fatal Crash Investigations will have been performed. Some general assumptions will therefore need to be made based on the crash data available and site observations.

The main feature of these crashes is that, in most cases, the vehicle making the left turn around the inside of the bend has lost control and run wide, subsequently impacting a vehicle coming in the opposite direction. It does not appear from the crash data as though the vehicles on the outside of the bend have cut the corner significantly.

The most likely reasons for these crashes to occur would include excessive approach speed, adverse camber on the bend and/or defective road surfacing. A basic examination of the road surfacing and geometry tends to rule out the latter possibilities.

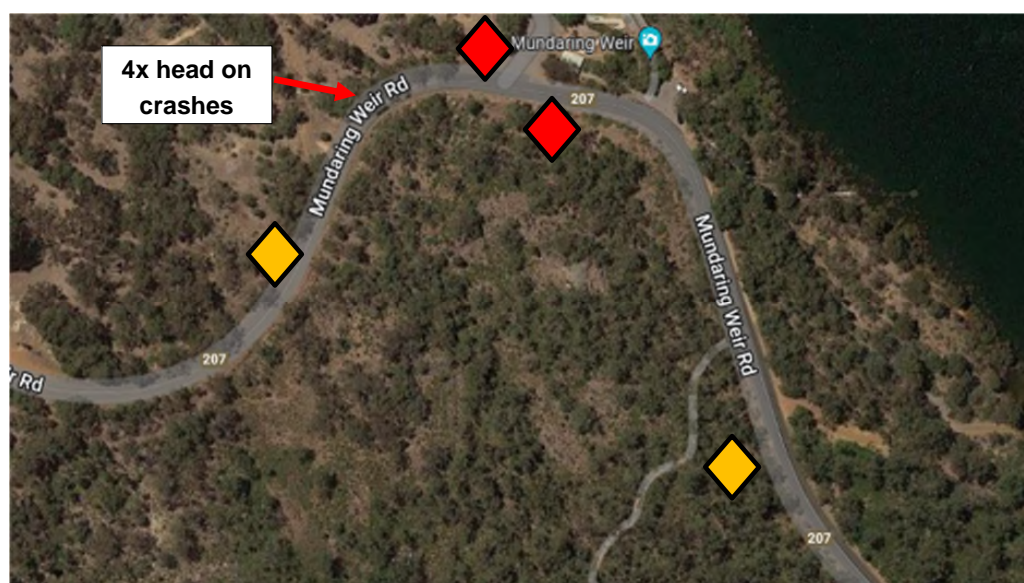
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Excessive approach speed may be due to a number of factors, including driver / rider behaviour, lack of warning signage or poor delineation of the road alignment. All four crashes occurred during daylight, so a lack of lighting does not appear to be the issue.

It is noted that advisory speed signs have been installed on the approaches to the outer bends in each direction, but not to the second bends being encountered. See **Figure 4.1** below.



**Figure 4.1:** Curve warning sign locations, existing (yellow) and recommended (Red).

This may lead drivers or riders to accelerate after negotiating the first bend, assuming that the un-signed second bend is not as severe. In the westbound direction, this is certainly not the case.

Whilst a more targeted investigation may be warranted, it would appear that provision of additional warning signs could provide an initial, easily implemented improvement at this location. The additional signs should include both additional curve warning signs with advisory speed tags, prior to the second bend in either direction, as well as chevron boards at each bend.

#### **4.7 Summary of Improvements**

The following is a summary of recommended improvements, and illustrated, where possible, in **SK01 – 08** in **Appendix B**.

##### **4.7.1 Intersection improvements**

Ensure lighting to all intersections are to Australian Standard. The cost estimate has assumed flag pole lighting.





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---

Schmitt Road

- Install Give Way (or Stop) sign and holding line
- Review and upgrade the road safety barrier

Crescent Road

- Install Give Way sign
- Install appropriate junction ahead sign on the side road

Hummerston Road

- Install hazard board on Mundaring Weir Road facing the side road
- Modify pedestrian crossing facility to ensure it meets current standards

Roach Road

- Install Give Way (or Stop) sign and holding line
- Install appropriate junction ahead sign on the side road

King Road

- Install Give Way (or Stop) sign and holding line
- Modify the advance warning of junction ahead sign to reflect acute angle of approach.

Hinkler Road, Croxton Road, Fern Road, Bahen Road, Paulls Valley Road

- Install Give Way (or Stop) sign and holding line
- Install hazard board on Mundaring Weir Road facing the side road

Asher Road

- Install Give Way (or Stop) sign and holding line

Gunjin Road

- Install Give Way (or Stop) sign and holding line
- Install hazard board on Mundaring Weir Road facing the side road
- Extend seal to approximately 30m from edge of Mundaring Weir Road

Lockwood Road

- Install Give Way (or Stop) sign and holding line
- Replace hazard board on Mundaring Weir Road facing the side road
- Extend seal to approximately 30m from edge of Mundaring Weir Road

Little Oven Road, Ashendon Road

- Install Give Way (or Stop) sign and holding line
- Install hazard board on Mundaring Weir Road facing the side road
- Seal side road to approximately 30m from edge of Mundaring Weir Road

S Ledge Road

- Install Give Way (or Stop) sign and holding line
- Install hazard board on Mundaring Weir Road facing the side road
- Repair pot holes and extend seal to approximately 30m from edge of Mundaring Weir Road

Reservoir Road

- Install Give Way (or Stop) sign and holding line
- Seal side road to approximately 30m from edge of Mundaring Weir Road



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- Install appropriate junction ahead sign on the side road

Chalet Rigi access

- Ensure upgrades to the access show adequate delineation of the Mundaring Weir Road carriageway

#### **4.7.2 Road widening**

Reservoir Road to Northern Boundary – widen road to provide sealed shoulders. Provision of audible edge lines, guide posts, retro-reflective raised pavement markers (RRPMs) through curves and audible centre lines at curves (where risk of head on collisions is perceived to be higher)

#### **4.7.3 Signage, line marking and delineation improvements along Mundaring Weir Road**

Mundaring Weir Car Park, as a priority - provide additional advance warning signage on approach to the two 90 degree bends and chevron alignment markers (D4-6) installed to these sub-standard curves.

Water crossing north of Chalet Rigi, as a priority:

- install reflectors on existing W-beam road safety barrier. For motorcyclist safety, ensure delineators are frangible and not sharp.
- Install RRPMs to centre line of curves

Hinkler Road to Fern Road

- Install reflectors on existing W-beams road safety barriers
- Install RRPMs to centre line at curves
- Install/replace guide posts

Fern Road – Reservoir Road

- Install audible edge lines to existing edge lines
- Install RRPMs to centre line at curves.
- Install audible centre lines at curves, and in particular where risk of head on collisions is perceived to be higher

Overhaul of existing signage. Undertake existing signage pick up, review their adequacy and modify accordingly to ensure it meets current MRWA requirements and a consistent signage strategy for the road. This includes review signage reflectivity and replacement of worn signs. As a minimum, signage should include of advance warning of road curves, particularly those downhill.

Provide audible road centrelines, particularly at curves in the road alignment and more particularly (if budget constrained) on uphill locations.

#### **4.7.4 Road side items**

Railway Road to Hinkler Road – relocate non-frangible power poles away from the road carriageway, particularly those within 1m of kerb face, or place underground.



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Hinkler Road to Fern Road, install W-beam road safety barriers to the locations shown. There is insufficient clear zone to trees. The City is required to make a decision on whether to provide a continuous barrier to the entire length or a treatment strategy to shield high risk zones. If the latter is preferred, the locations recommended in **Appendix B** are at curves with a perceived higher risk of run-off road incidents. Typically, MRWA use a qualitative risk assessment (Queensland Main Roads program Roadside Incident Severity Calculator (RISC)) for undertaking a hazard risk assessment. This should be undertaken to the locations of barriers recommended. The W-beam road safety barriers should have motorcyclist protection installed.

Replace all non-crashworthy end terminals to the crash worthy type (to comply with existing standards)

#### **4.7.5 Lighting**

Review the adequacy of lighting along Mundaring Weir Road and implement an upgrade programme. The cost estimate has assumed upgrade of existing lighting to LED fixtures.

#### **4.7.6 Improvements to pedestrian and cyclist facilities**

Railway Road to Hinkler Road – widen and upgrade the path to 3m on the south side of Mundaring Weir Road.

The pedestrian crossing at Hummerston Road should be relocated to an appropriate location.

Ensure any upgrades to drainage grates are cycle friendly

#### **4.7.7 General maintenance**

Sweep of the road on a regular basis to remove any loose material.



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## 5 COSTINGS

The following table outlines an initial 'ball park' cost estimate for each of the proposed treatments, with the indicative locations of treatments shown (where possible) on **SK01 – 08** in **Appendix B**. These are based on unit costs, and may vary significantly depending upon specific conditions encountered. No allowance has been made for works to underground services nor design works. As such, the estimates should be updated and refined once preliminary design investigations have been undertaken.

Item	Description	Unit	Qty	Rate	Amount	Priority
<b>1</b>	<b>Start: Railway Rd (Cha 0), End: Hinkler Rd (Cha 1950)</b>					
	<b>Signs and Lines</b>					
1.1	Intersection signs and lines (Schmitt, Crescent, Hummerston, Roach, King & Hinkler Rd)	No.	6	\$2,000	\$12,000	1
1.2	Midblock signs	Item			\$5,000	1
	<b>Pedestrian &amp; Cyclists</b>					
	<i>Upgrade shared path to 3m width</i>					4
1.3	Clearing vegetation 1.5m width	m2	3,000	\$10	\$30,000	
1.4	Remove obsolete/broken footpath	m	400	\$80	\$32,000	
1.5	Tree removal	No.	300	\$800	\$240,000	
1.6	Widen shared path by 1m	m	1,600	\$60	\$96,000	
1.7	New shared path 3m	m	400	\$120	\$48,000	
1.8	Relocate power pole	No.	2	\$12,000	\$24,000	
1.9	Upgrade drain grates to current (cycling friendly) standard	No.	21	\$3,000	\$63,000	4
	<i>Hummerston Road pedestrian crossing</i>					2
1.10	Remove existing path	m	30	\$80	\$2,400	
1.11	Relocate power pole	No.	1	\$12,000	\$12,000	
1.12	New footpath 2m width	m	30	\$100	\$3,000	
1.13	Install new pedestrian ramp	No.	2	\$500	\$1,000	
	<b>Lighting</b>					
1.14	Upgrade street lighting (midblock)	No.	16	\$3,500	\$56,000	4
1.15	Upgrade street lighting (intersection)	No.	7	\$12,000	\$84,000	1
	<b>Roadside Items</b>					
1.16	Schmitt Rd barrier works - remove existing barrier end treatment, extend barrier and install crashworthy end treatment	Item			\$15,000	3
1.17	Relocate power pole (road hazard within 1m of traffic lane)	No.	4	\$12,000	\$48,000	5
1.18	Traffic Management Provisional Amount	%	30%	\$772,000	\$231,600	
	<b>Subtotal (excl ug services)</b>				\$1,003,000	





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Item	Description	Unit	Qty	Rate	Amount	Priority
<b>2</b>	<b>Start: Hinkler Rd (Cha 1950), End: Fern Rd (Cha 5550)</b> <b>Signs and Lines</b>					
2.1	Midblock Signs	Item	1	\$5,000	\$5,000	1
2.2	Intersection signs and lines (Croxtan & Fern Rd)	No.	2	\$2,000	\$4,000	1
2.3	RRPMs on centre line through entire section	No.	1,250	\$13	\$16,250	2
2.4	Audible centreline - reverse curve east of Croxtan Rd (Cha. 2,400-3000)	m	600	\$4	\$2,400	2
2.5	Audible centreline - curve at Fern Rd (Cha 5,200 - 5,700)	m	500	\$4	\$2,000	2
	<b>Pedestrian &amp; Cyclists</b>					
2.6	Upgrade drain grates to current (cycling friendly) standard	No.	13	\$3,000	\$39,000	4
	<b>Lighting</b>					
2.7	Upgrade street lighting (midblock)	No.	1	\$3,500	\$3,500	4
2.8	Upgrade street lighting (intersection)	No.	4	\$15,000	\$60,000	1
	<b>Roadside Items</b>					
2.9	Cha. 2,600 road safety barrier	m	180	\$350	\$63,000	3
2.10	Cha. 3,350 road safety barrier	m	125	\$350	\$43,750	3
2.11	Cha. 3,600 road safety barrier	m	165	\$350	\$57,750	3
2.12	Relocate power pole for Item 2.11 install	No.	1	\$12,000	\$12,000	3
2.13	Cha. 4,500 road safety barrier	m	135	\$350	\$47,250	3
2.14	Cha. 5,400 road safety barrier	m	310	\$350	\$108,500	3
2.15	Cha. 5,600 road safety barrier	m	95	\$350	\$33,250	3
2.16	Replace non-crashworthy end treatments to current standards	No.	4	\$6,500	\$26,000	3
2.17	Install guideposts to entire section	No.	500	\$65	\$32,500	2
2.18	Install reflectors on existing barrier	m	520	\$15	\$7,800	2
	<i>Chalet Rigi Access</i>					
2.19	Reflectors on existing barrier	m	170	\$15	\$2,550	2
2.20	RRPMs on centreline through curves	No.	70	\$13	\$910	2
2.21	Flag lighting poles	No.	3	\$4,000	\$12,000	1
2.22	Traffic Management	%	30%	\$580,000	\$174,000	
	<b>Subtotal (excl ug services)</b>				\$753,410	
<b>3</b>	<b>Start: Fern Rd (Cha 5550), End: Northern boundary (Cha 15800)</b> <b>Roadworks</b>					
3.1	Extend seal at intersections (Gunjin, Lockwood, Little Oven, Ashendon, S Ledge, Reservoir Rd) <i>Road widening, from 400m north of Reservoir Rd to Northern Boundary</i>	No.	6	\$15,000	\$90,000	5
3.2	Clearing vegetation 3m width	m2	6,000	\$10	\$60,000	
3.3	Tree removal	No.	300	\$800	\$240,000	
3.4	Imported fill (bank, placed and compacted)	m3	6,000	\$30	\$180,000	



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Item	Description	Unit	Qty	Rate	Amount	Priority
3.5	Cutting embankment (Clay+Rock)	m3	3,000	\$80	\$240,000	
3.6	Kerb Removal	m	1,200	\$30	\$36,000	
3.7	Reinstall Kerb	m	1,200	\$40	\$48,000	
3.8	Drainage (table drain and culverts)	m3	2,000	\$150	\$299,000	
3.9	Pavement	m2	4,000	\$125	\$500,000	
3.10	Guideposts	No.	135	\$65	\$8,775	
3.11	Audible edge line	m	2,000	\$4	\$8,000	
3.12	RRPMs on centre line	No.	340	\$13	\$4,420	
3.13	Audible centreline	m	1,000	\$4	\$4,000	
	<b>Signs and Line</b>					
3.14	Intersection signs and lines (Bahen, Pauls Valley, Asher, Gunjin, Lockwood, Little Oven, Ashendon, S Ledge, Reservoir Rd)	No.	9	\$2,000	\$18,000	1
3.15	Signs in the vicinity of Mundaring Weir carpark	No.	6	\$350	\$2,100	1
3.16	Audible Edge Line (Fern Rd to 400m north of Reservoir Rd)	m	18,800	\$4	\$75,200	5
3.17	RRPMs on centre line (Cha 9,300 - 14,900)	No.	1,900	\$20	\$38,000	2
3.18	Audible centreline (Cha 9,300 - 14,900)	m	5,600	\$4	\$22,400	2
3.19	Upgrade street lighting (intersection)	No.	9	\$15,000	\$135,000	1
3.20	Traffic Management	%	30%	\$2,009,000	\$602,700	
	<b>Subtotal (excl ug services)</b>				\$2,611,595	
	<b>TOTAL (excluding U/G services)</b>				\$4,368,005	



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## 6 STAGING / ACTION PLAN

Priority/staging are tagged on the cost estimates in section 5 and grouped below in stages:

### Stage 1:

This stage predominantly concentrates on signage, line marking to the length of the road and lighting to intersections and comprises:

- Complete line marking, sign installation and RRPM work to recently widened section of Mundaring Weir Road, Fern Road to 400m north of Reservoir Road (not listed in cost estimate, understood to be outstanding works);
- Ongoing and regular general maintenance (not listed in cost estimate) including road sweeping and pruning vegetation to maintain sight lines at intersections;
- Advance warning and curve delineation in vicinity of the Mundaring Weir Carpark;
- Intersection signs and line marking;
- Overhaul of signage to the length of Mundaring Weir Road, under consideration; and
- Lighting to intersections and Chalet Rigi access.

Estimated Cost = \$440,000

### Stage 2:

This stage focuses on guidance to vehicles at night by use of RRPMS and guideposts, where none exist and the installation of audible centre lines at curves with past history of crashes. The works comprise:

- Relocate Hummerston Road pedestrian crossing;
- RRPMS to centre line, Hinkler - Fern Road;
- Guideposts to Hinkler - Fern Road;
- Audible centre line to Cha 2,400 – 3,000 and Cha 5,200 – 5,700 (curves with past history of crashes);
- Reflectors to existing barriers, Hinkler - Fern Road; and
- RRPMS to centre line and audible centreline to Cha 9,300 – 14,900.

Estimated Cost = \$190,000

### Stage 3:

This stage are works to barriers, existing and proposed and comprises the following:

- Replace non-crash worthy end treatments to current standards;
- Schmitt Road barrier upgrade; and
- Road safety barrier installation in the vicinity of curves, subject to RISC analysis
  - Cha 2,600: site has past history of head on collision
  - Cha 3,350: very tight curve with tree hazards, constrained by driveway, no past history of crashes
  - Cha 3,600: embankment hazard but no past history of crashes
  - Cha 4,500: southbound straight into a curve with trees and embankment hazards
  - Cha 5,400 & 5,600: past history of crashes with embankment, trees and power pole hazards

Estimated Cost = \$530,000

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#### Stage 4:

This stage consists of works to upgrade pedestrian facilities and lighting, namely:

- Upgrade shared path Railway to Hinkler Road;
- Upgrade midblock lighting; and
- Upgrade drainage grates to current cycle friendly standards.

Estimated Cost = \$825,000

#### Stage 5:

This stage covers the more costly items including the upgrade/widening of the Mundaring Weir Road north of Reservoir that has yet to be widened. The works comprise:

- Road widening to section 400m north of Reservoir Road to the City's northern boundary;
- Extend seal to intersections (6 of);
- Audible edge line (Fern Road to 400m north of Reservoir Road); and
- Relocate power pole hazards (within 1m of traffic lane).

Estimated Cost = \$2,400,000

The total estimate of the five stages is approximately \$4.4m as summarised in **Table 6.1**.

**Table 6.1: Estimated Cost per Stage**

Stage	Amount	Percentage	Cumulative Amount	Cumulative Percentage
1	\$440,000	10%	\$440,000	10%
2	\$190,000	4%	\$630,000	14%
3	\$530,000	12%	\$1,160,000	26%
4	\$825,000	19%	\$1,985,000	45%
5	\$2,400,000	55%	\$4,385,000	100%
Total	\$4,385,000	100%	\$4,385,000	100%



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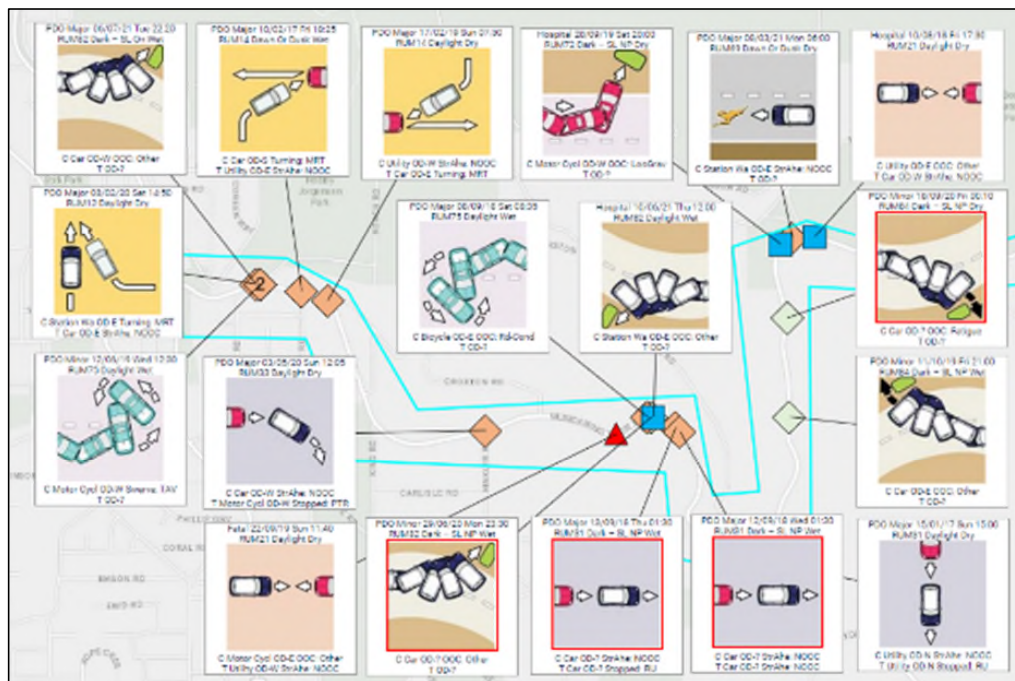
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## **APPENDIX A: TRAFFIC DATA AND CRASH HISTORY**

Client: City of Kalamunda

Project: Mundaring Weir Rd - Road Safety Investigation



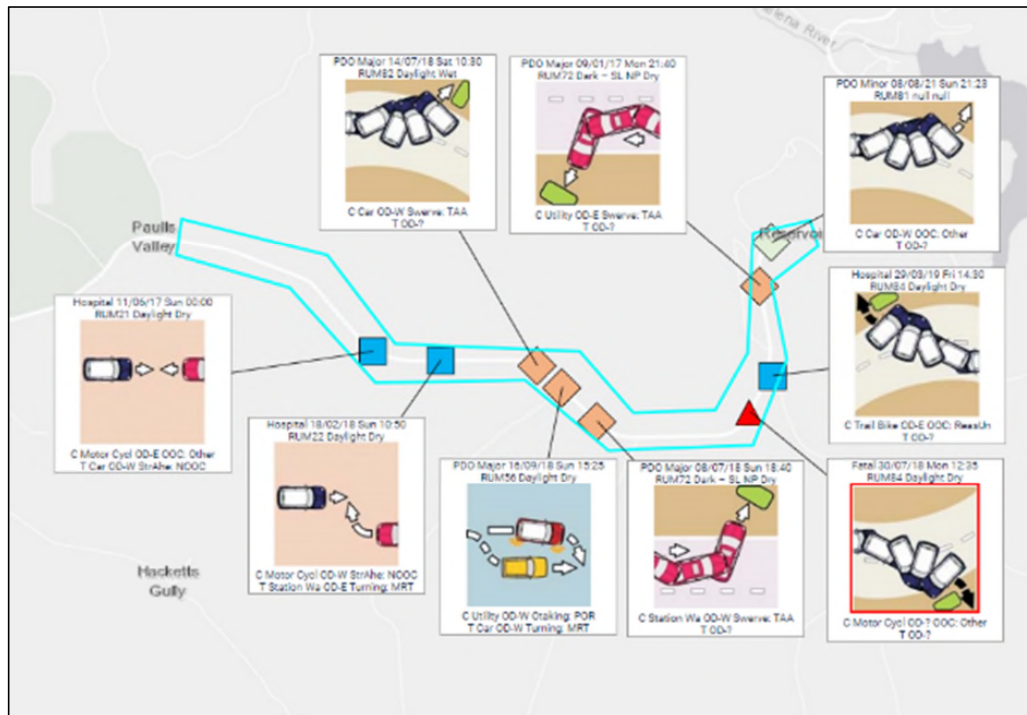
Area Details		Centre: (-31.976, 116.087) (Shape)				
Date Range		01/01/17 to 31/12/21				
	Severity	Date	Time	Nature	RUM Code	Crash Number
1020620 - MUNDARING WEIR RD						
zoom	PDO Major	2021-07-06	22:20	Hit Object	82	2021300036
zoom	PDO Major	2020-02-08	14:50	Right Angle	12	2020633132
zoom	PDO Minor	2019-06-12	12:30	Non Collision	75	2019161762
zoom	PDO Major	2017-02-10	18:25	Right Angle	14	2017043471
zoom	PDO Major	2019-02-17	07:50	Right Angle	14	2019035784
zoom	PDO Major	2020-05-03	12:05	Rear End	33	2020692794
zoom	Fatal	2019-09-22	11:40	Head On	21	2019218580
zoom	PDO Major	2018-09-08	08:35	Non Collision	75	2018245411
zoom	PDO Minor	2020-06-29	23:30	Hit Object	82	2020745784
zoom	Hospital	2021-06-10	12:00	Hit Object	82	2021312301
zoom	PDO Major	2018-09-13	01:30	Rear End	31	2018253763
zoom	PDO Major	2018-09-12	01:30	Rear End	31	2018253855
zoom	PDO Minor	2019-10-11	21:00	Hit Object	84	2019282965
zoom	PDO Minor	2020-09-18	00:10	Hit Object	84	2020950162
zoom	Hospital	2019-09-28	20:00	Hit Object	72	2019268420
zoom	PDO Major	2021-03-08	06:00	Hit Animal	69	2021089502
zoom	Hospital	2018-08-10	17:30	Head On	21	2018210363
1020044 - ALDERSYDE RD						
zoom	PDO Major	2017-01-15	15:00	Rear End	31	2017012096
Total:18						





Client: City of Kalamunda

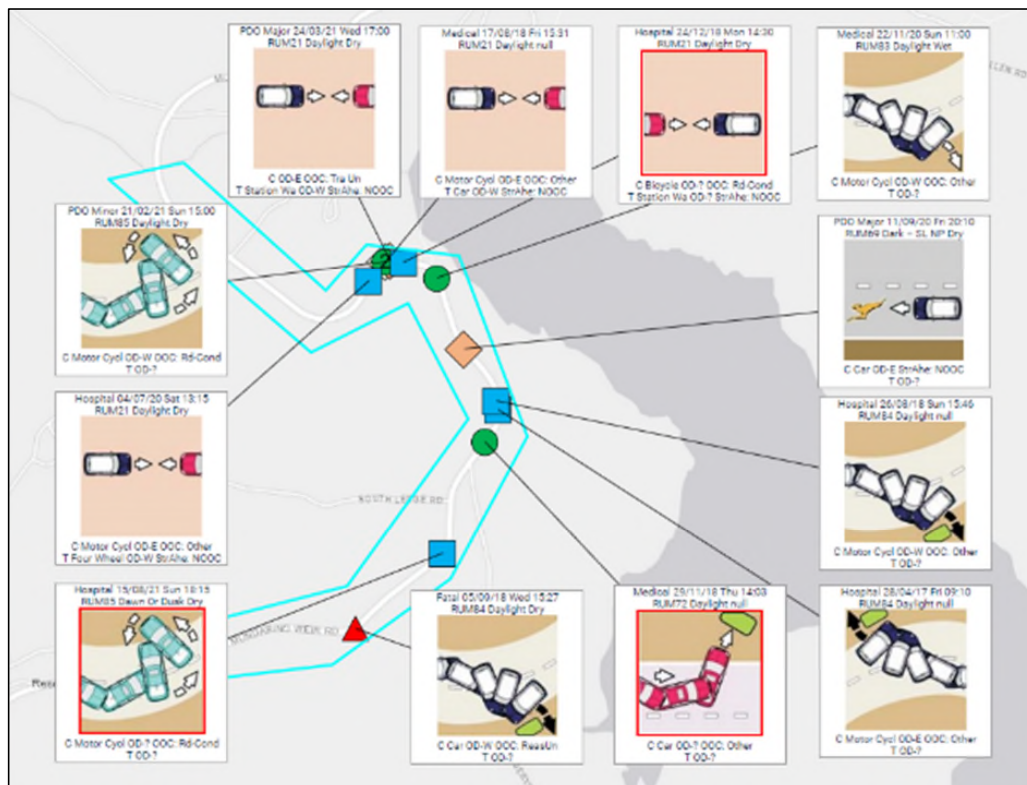
Project: Mundaring Weir Rd - Road Safety Investigation



Area Details		Centre: (-31.973, 116.139) (Shape)				
Date Range		01/01/17 to 31/12/21				
Severity	Date	Time	Nature	RUM Code	Crash Number	
1022004 - ASHENDON RD (F)						
zoom	Hospital	2019-03-29	14:30	Hit Object	84	2019089301
1020620 - MUNDARING WEIR RD						
zoom	Hospital	2017-06-11	00:00	Head On	21	2017140745
zoom	Hospital	2018-02-18	10:50	Right Turn Thru	22	2018010185
zoom	PDO Major	2018-07-14	10:30	Hit Object	82	2018191710
zoom	PDO Major	2018-09-16	15:25	Sideswipe Same Dirn	56	2018255001
zoom	PDO Major	2018-07-08	18:40	Hit Object	72	2018183321
zoom	Fatal	2018-07-30	12:35	Hit Object	84	2018167825
zoom	PDO Major	2017-01-09	21:40	Hit Object	72	2017011982
zoom	PDO Minor	2021-08-08	21:23	Non Collision	81	2021438846
Total:9						

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Area Details		Centre: (-31.962, 116.163) (Shape)				
Date Range		01/01/17 to 31/12/21				
Severity	Date	Time	Nature	RUM Code	Crash Number	
1020620 - MUNDARING WEIR RD						
zoom	Fatal	2018-09-05	15:27	Hit Object	84	2018201005
zoom	Hospital	2021-08-15	18:15	Non Collision	85	2021513761
zoom	Medical	2018-11-29	14:03	Hit Object	72	2018268404
zoom	Hospital	2017-04-28	09:10	Hit Object	84	2017139231
zoom	Hospital	2018-08-26	15:46	Hit Object	84	2018207902
zoom	PDO Major	2020-09-11	20:10	Hit Animal	69	2020808143
zoom	Medical	2020-11-22	11:00	Non Collision	83	2020954480
zoom	Hospital	2018-12-24	14:30	Head On	21	2018344892
zoom	PDO Major	2021-03-24	17:00	Head On	21	2021116640
zoom	Medical	2018-08-17	15:31	Head On	21	2018194451
zoom	PDO Minor	2021-02-21	15:00	Non Collision	85	2021105823
zoom	Hospital	2020-07-04	13:15	Head On	21	2020741912
Total:12						



VirtWeeklyVehicle-63 Page 1



## **MetroCount Traffic Executive**

### **Weekly Vehicle Counts (Virtual Week)**

#### **VirtWeeklyVehicle-63 -- English (ENU)**

##### **Datasets:**

**Site:** [MUNDARING WEIR RD 1] Outside # 108 <60>  
**Attribute:** PIESSE BROOK  
**Direction:** 6 - West bound A>B, East bound B>A. **Lane:** 0  
**Survey Duration:** 12:00 Wednesday, May 1, 2019 => 9:18 Wednesday, May 8, 2019,  
**Zone:**  
**File:** MUNDARING WEIR RD 1 0 2019-05-08 0919.EC0 (Plus )  
**Identifier:** MK91SQS4 MC56-L5 [MC55] (c)Microcom 19Oct04  
**Algorithm:** Factory default axle (v4.06)  
**Data type:** Axle sensors - Paired (Class/Speed/Count)

##### **Profile:**

**Filter time:** 12:00 Wednesday, May 1, 2019 => 9:18 Wednesday, May 8, 2019 (6.88794)  
**Included classes:** 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12  
**Speed range:** 10 - 160 km/h.  
**Direction:** North, East, South, West (bound), P = East  
**Separation:** GapX > 0 sec, Span 0 - 100 metre  
**Name:** 60kmh\_roads  
**Scheme:** Vehicle classification (AustRoads94)  
**Units:** Metric (metre, kilometre, m/s, km/h, kg, tonne)  
**In profile:** Vehicles = 12168 / 12188 (99.84%)

VirtWeeklyVehicle-63 Page 2

**Weekly Vehicle Counts (Virtual Week)****VirtWeeklyVehicle-63****Site:** MUNDARING WEIR RD 1.0.1WE**Description:** Outside # 108 <60>**Filter time:** 12:00 Wednesday, May 1, 2019 => 9:18 Wednesday, May 8, 2019**Scheme:** Vehicle classification (AustRoads94)**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) GapX(>0) Span(0 - 100)

	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Averages	
Hour								1 - 5	1 - 7
0000-0100	0.0	1.0	0.0	6.0	0.0	6.0	6.0	1.4	2.7
0100-0200	1.0	1.0	2.0	1.0	0.0	2.0	1.0	1.0	1.1
0200-0300	1.0	2.0	2.0	0.0	1.0	0.0	6.0	1.2	1.7
0300-0400	2.0	3.0	4.0	1.0	2.0	0.0	3.0	2.4	2.1
0400-0500	2.0	0.0	1.0	5.0	1.0	1.0	3.0	1.8	1.9
0500-0600	12.0	13.0	14.0	11.0	14.0	6.0	10.0	12.8	11.4
0600-0700	50.0	45.0	50.0	49.0	43.0	33.0	36.0	47.4	43.7
0700-0800	107.0	106.0	110.0	135.0	106.0	67.0	171.0	112.8	114.6
0800-0900	109.0	143.0	60.0	132.0	125.0	108.0	235.0	113.8	130.3
0900-1000	103.0	72.0	0.0	104.0	107.0	162.0	212.0	77.2	108.6
1000-1100	109.0	91.0	*	104.0	95.0	187.0	309.0	99.8	149.2
1100-1200	101.0	103.0	*	102.0	126.0	240.0	344.0	108.0	169.3
1200-1300	97.0	114.0	89.0	101.0	133.0	210.0	319.0	106.8	151.9
1300-1400	98.0	120.0	110.0	106.0	124.0	221.0	297.0	111.6	153.7
1400-1500	92.0	125.0	94.0	119.0	146.0	174.0	226.0	115.2	139.4
1500-1600	122.0	129.0	130.0	163.0	161.0	160.0	209.0	141.0	153.4
1600-1700	118.0	145.0	151.0	155.0	155.0	163.0	177.0	144.8	152.0
1700-1800	120.0	144.0	136.0	143.0	132.0	118.0	113.0	135.0	129.4
1800-1900	55.0	67.0	83.0	94.0	84.0	67.0	51.0	76.6	71.6
1900-2000	29.0	32.0	35.0	42.0	37.0	34.0	15.0	35.0	32.0
2000-2100	18.0	19.0	32.0	20.0	26.0	30.0	14.0	23.0	22.7
2100-2200	10.0	18.0	18.0	28.0	24.0	37.0	6.0	19.6	20.1
2200-2300	10.0	11.0	9.0	13.0	37.0	23.0	3.0	16.0	15.1
2300-2400	0.0	3.0	5.0	10.0	13.0	9.0	0.0	6.2	5.7
<b>Totals</b>									
0700-1900	1231.0	1359.0	*	1458.0	1494.0	1877.0	2663.0	1342.6	1623.4
0600-2200	1338.0	1473.0	*	1597.0	1624.0	2011.0	2734.0	1467.6	1741.9
0600-0000	1348.0	1487.0	*	1620.0	1674.0	2043.0	2737.0	1489.8	1762.8
0000-0000	1366.0	1507.0	*	1644.0	1692.0	2058.0	2766.0	1510.3	1783.8
<b>AM Peak</b>									
	1000	0800	*	0700	1100	1100	1100		
	109.0	143.0	*	135.0	126.0	240.0	344.0		
<b>PM Peak</b>									
	1500	1600	1600	1500	1500	1300	1200		
	122.0	145.0	151.0	163.0	161.0	221.0	319.0		

\* - No data.



SpeedHist-65 Page 1



## MetroCount Traffic Executive

### Speed Histogram

#### SpeedHist-65 -- English (ENU)

##### Datasets:

**Site:** [MUNDARING WEIR RD 1] Outside # 108 <60>  
**Attribute:** PIESSE BROOK  
**Direction:** 6 - West bound A>B, East bound B>A. **Lane:** 0  
**Survey Duration:** 12:00 Wednesday, May 1, 2019 => 9:18 Wednesday, May 8, 2019,  
**Zone:**  
**File:** MUNDARING WEIR RD 1 0 2019-05-08 0919.EC0 (Plus )  
**Identifier:** MK91SQS4 MC56-L5 [MC55] (c)Microcom 19Oct04  
**Algorithm:** Factory default axle (v4.06)  
**Data type:** Axle sensors - Paired (Class/Speed/Count)

##### Profile:

**Filter time:** 12:00 Wednesday, May 1, 2019 => 9:18 Wednesday, May 8, 2019 (6.88794)  
**Included classes:** 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12  
**Speed range:** 10 - 160 km/h.  
**Direction:** North, East, South, West (bound), P = East  
**Separation:** GapX > 0 sec, Span 0 - 100 metre  
**Name:** 60kmh\_roads  
**Scheme:** Vehicle classification (AustRoads94)  
**Units:** Metric (metre, kilometre, m/s, km/h, kg, tonne)  
**In profile:** Vehicles = 12168 / 12188 (99.84%)

##### Speed Statistics

**Direction:** EW  
**Vehicles** = 12168  
**Posted speed limit** = 60 km/h, Exceeding = 4929 (40.51%), Mean Exceeding = 65.16 km/h  
**Maximum** = 108.1 km/h, **Minimum** = 10.4 km/h, **Mean** = 58.3 km/h  
**85% Speed** = 65.2 km/h, **95% Speed** = 70.2 km/h, **Median** = 58.3 km/h  
**20 km/h Pace** = 49 - 69, **Number in Pace** = 10428 (85.70%)  
**Variance** = 73.86, **Standard Deviation** = 8.59 km/h

VirtWeeklyVehicle-66 Page 1



## **MetroCount Traffic Executive**

### **Weekly Vehicle Counts (Virtual Week)**

#### **VirtWeeklyVehicle-66 -- English (ENU)**

##### **Datasets:**

**Site:** [MUNDARING WEIR RD 2] 300m North of KING RD <60>  
**Attribute:** KALAMUNDA  
**Direction:** 7 - North bound A>B, South bound B>A. **Lane:** 0  
**Survey Duration:** 12:00 Wednesday, May 1, 2019 => 9:09 Wednesday, May 8, 2019,  
**Zone:**  
**File:** MUNDARING WEIR RD 2 0 2019-05-08 0910.EC0 (Plus )  
**Identifier:** MJ39RD1C MC56-L5 [MC55] (c)Microcom 19Oct04  
**Algorithm:** Factory default axle (v4.06)  
**Data type:** Axle sensors - Paired (Class/Speed/Count)

##### **Profile:**

**Filter time:** 12:00 Wednesday, May 1, 2019 => 9:09 Wednesday, May 8, 2019 (6.8817)  
**Included classes:** 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12  
**Speed range:** 10 - 160 km/h.  
**Direction:** North, East, South, West (bound), P = North  
**Separation:** GapX > 0 sec, Span 0 - 100 metre  
**Name:** 60kmh\_roads  
**Scheme:** Vehicle classification (AustRoads94)  
**Units:** Metric (metre, kilometre, m/s, km/h, kg, tonne)  
**In profile:** Vehicles = 15092 / 15117 (99.83%)



VirtWeeklyVehicle-66 Page 2

**Weekly Vehicle Counts (Virtual Week)****VirtWeeklyVehicle-66****Site:** MUNDARING WEIR RD 2.0.1NS**Description:** 300m North of KING RD <60>**Filter time:** 12:00 Wednesday, May 1, 2019 => 9:09 Wednesday, May 8, 2019**Scheme:** Vehicle classification (AustRoads94)**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) GapX(>0) Span(0 - 100)

	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Averages	
Hour								1 - 5	1 - 7
0000-0100	0.0	2.0	0.0	6.0	0.0	9.0	14.0	1.6	4.4
0100-0200	2.0	1.0	2.0	0.0	0.0	3.0	5.0	1.0	1.9
0200-0300	2.0	4.0	3.0	0.0	2.0	1.0	8.0	2.2	2.9
0300-0400	2.0	3.0	4.0	1.0	2.0	0.0	2.0	2.4	2.0
0400-0500	2.0	2.0	1.0	4.0	1.0	1.0	3.0	2.0	2.0
0500-0600	15.0	20.0	20.0	17.0	18.0	9.0	11.0	18.0	15.7
0600-0700	68.0	61.0	68.0	55.0	60.0	40.0	40.0	62.4	56.0
0700-0800	132.0	127.0	143.0	162.0	130.0	80.0	176.0	138.8	135.7
0800-0900	<b>155.0</b>	<b>174.0</b>	100.0	<b>183.0</b>	<b>165.0</b>	124.0	237.0	<b>155.4</b>	162.6
0900-1000	126.0	103.0	0.0	137.0	146.0	196.0	230.0	102.4	134.0
1000-1100	132.0	125.0	*	130.0	124.0	227.0	326.0	127.8	177.3
1100-1200	130.0	128.0	*	140.0	153.0	<b>288.0</b>	<b>381.0</b>	137.8	<b>203.3</b>
1200-1300	127.0	139.0	119.0	131.0	166.0	<b>254.0</b>	328.0	136.4	180.6
1300-1400	124.0	137.0	119.0	129.0	149.0	240.0	<b>329.0</b>	131.6	175.3
1400-1500	125.0	148.0	144.0	154.0	166.0	218.0	224.0	147.4	168.4
1500-1600	168.0	176.0	175.0	207.0	211.0	188.0	252.0	187.4	196.7
1600-1700	<b>183.0</b>	<b>204.0</b>	<b>198.0</b>	<b>209.0</b>	<b>212.0</b>	199.0	189.0	<b>201.2</b>	<b>199.1</b>
1700-1800	165.0	190.0	182.0	192.0	192.0	141.0	134.0	184.2	170.9
1800-1900	82.0	96.0	107.0	138.0	103.0	83.0	53.0	105.2	94.6
1900-2000	40.0	43.0	55.0	60.0	54.0	44.0	17.0	50.4	44.7
2000-2100	25.0	33.0	34.0	39.0	38.0	31.0	14.0	33.8	30.6
2100-2200	13.0	21.0	21.0	33.0	28.0	52.0	7.0	23.2	25.0
2200-2300	10.0	13.0	13.0	18.0	43.0	36.0	6.0	19.4	19.9
2300-2400	1.0	4.0	6.0	11.0	12.0	13.0	1.0	6.8	6.9
<b>Totals</b>									
0700-1900	1649.0	1747.0	*	1912.0	1917.0	2238.0	2859.0	1755.5	1998.5
0600-2200	1795.0	1905.0	*	2099.0	2097.0	2405.0	2937.0	1925.3	2154.8
0600-0000	1806.0	1922.0	*	2128.0	2152.0	2454.0	2944.0	1951.5	2181.5
0000-0000	1829.0	1954.0	*	2156.0	2175.0	2477.0	2987.0	1978.7	2210.4
<b>AM Peak</b>									
	0800	0800	*	0800	0800	1100	1100		
	155.0	174.0	*	183.0	165.0	288.0	381.0		
<b>PM Peak</b>									
	1600	1600	1600	1600	1600	1200	1300		
	183.0	204.0	198.0	209.0	212.0	254.0	329.0		

\* - No data.

SpeedHist-68 Page 1



## MetroCount Traffic Executive

### Speed Histogram

#### SpeedHist-68 -- English (ENU)

##### Datasets:

**Site:** [MUNDARING WEIR RD 2] 300m North of KING RD <60>  
**Attribute:** KALAMUNDA  
**Direction:** 7 - North bound A>B, South bound B>A. **Lane:** 0  
**Survey Duration:** 12:00 Wednesday, May 1, 2019 => 9:09 Wednesday, May 8, 2019,  
**Zone:**  
**File:** MUNDARING WEIR RD 2 0 2019-05-08 0910.EC0 (Plus )  
**Identifier:** MJ39RD1C MC56-L5 [MC55] (c)Microcom 19Oct04  
**Algorithm:** Factory default axle (v4.06)  
**Data type:** Axle sensors - Paired (Class/Speed/Count)

##### Profile:

**Filter time:** 12:00 Wednesday, May 1, 2019 => 9:09 Wednesday, May 8, 2019 (6.8817)  
**Included classes:** 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12  
**Speed range:** 10 - 160 km/h.  
**Direction:** North, East, South, West (bound), P = North  
**Separation:** GapX > 0 sec, Span 0 - 100 metre  
**Name:** 60kmh\_roads  
**Scheme:** Vehicle classification (AustRoads94)  
**Units:** Metric (metre, kilometre, m/s, km/h, kg, tonne)  
**In profile:** Vehicles = 15092 / 15117 (99.83%)

#### Speed Statistics

**Direction:** NS  
**Vehicles** = 15092  
**Posted speed limit** = 60 km/h, Exceeding = 8181 (54.21%), Mean Exceeding = 66.12 km/h  
**Maximum** = 131.1 km/h, **Minimum** = 10.7 km/h, **Mean** = 60.8 km/h  
**85% Speed** = 67.7 km/h, **95% Speed** = 73.4 km/h, **Median** = 60.5 km/h  
**20 km/h Pace** = 51 - 71, **Number in Pace** = 12855 (85.18%)  
**Variance** = 70.27, **Standard Deviation** = 8.38 km/h



VirtWeeklyVehicle-70 Page 1



## **MetroCount Traffic Executive**

### **Weekly Vehicle Counts (Virtual Week)**

#### **VirtWeeklyVehicle-70 -- English (ENU)**

##### **Datasets:**

**Site:** [MUNDARING WEIR RD 3] 33 m West of VALLEY RD <60>  
**Attribute:** KALAMUNDA  
**Direction:** 6 - West bound A>B, East bound B>A. **Lane:** 0  
**Survey Duration:** 12:00 Wednesday, May 1, 2019 => 9:00 Wednesday, May 8, 2019,  
**Zone:**  
**File:** MUNDARING WEIR RD 3 0 2019-05-08 0900.EC0 (Plus )  
**Identifier:** JM12PA3T MC56-L5 [MC55] (c)Microcom 19Oct04  
**Algorithm:** Factory default axle (v4.06)  
**Data type:** Axle sensors - Paired (Class/Speed/Count)

##### **Profile:**

**Filter time:** 12:00 Wednesday, May 1, 2019 => 9:00 Wednesday, May 8, 2019 (6.87502)  
**Included classes:** 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12  
**Speed range:** 10 - 160 km/h.  
**Direction:** North, East, South, West (bound), P = East  
**Separation:** GapX > 0 sec, Span 0 - 100 metre  
**Name:** 60kmh\_roads  
**Scheme:** Vehicle classification (AustRoads94)  
**Units:** Metric (metre, kilometre, m/s, km/h, kg, tonne)  
**In profile:** Vehicles = 20204 / 20235 (99.85%)

VirtWeeklyVehicle-70 Page 2

**Weekly Vehicle Counts (Virtual Week)****VirtWeeklyVehicle-70****Site:** MUNDARING WEIR RD 3.0.1WE**Description:** 33 m West of VALLEY RD <60>**Filter time:** 12:00 Wednesday, May 1, 2019 => 9:00 Wednesday, May 8, 2019**Scheme:** Vehicle classification (AustRoads94)**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) GapX(>0) Span(0 - 100)

	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Averages	
								1 - 5	1 - 7
<b>Hour</b>									
0000-0100	0.0	4.0	0.0	11.0	0.0	15.0	15.0	3.0	6.4
0100-0200	3.0	4.0	2.0	2.0	1.0	3.0	8.0	2.4	3.3
0200-0300	3.0	7.0	4.0	0.0	2.0	1.0	8.0	3.2	3.6
0300-0400	4.0	5.0	5.0	6.0	6.0	0.0	3.0	5.2	4.1
0400-0500	7.0	4.0	3.0	11.0	2.0	6.0	4.0	5.4	5.3
0500-0600	32.0	28.0	26.0	29.0	29.0	15.0	12.0	28.8	24.4
0600-0700	95.0	92.0	97.0	80.0	82.0	47.0	58.0	89.2	78.7
0700-0800	182.0	178.0	193.0	208.0	175.0	109.0	197.0	187.2	177.4
0800-0900	<b>213.0</b>	<b>227.0</b>	155.0	<b>244.0</b>	<b>218.0</b>	163.0	264.0	<b>211.4</b>	212.0
0900-1000	182.0	150.0	0.0	195.0	202.0	253.0	303.0	145.8	183.6
1000-1100	185.0	170.0	*	165.0	173.0	308.0	383.0	173.3	230.7
1100-1200	173.0	179.0	*	182.0	205.0	<b>363.0</b>	<b>444.0</b>	184.8	<b>257.7</b>
1200-1300	181.0	198.0	168.0	183.0	215.0	298.0	<b>402.0</b>	189.0	235.0
1300-1400	160.0	165.0	173.0	167.0	193.0	287.0	380.0	171.6	217.9
1400-1500	180.0	209.0	212.0	217.0	216.0	<b>299.0</b>	297.0	206.8	232.9
1500-1600	217.0	249.0	237.0	<b>281.0</b>	<b>288.0</b>	260.0	304.0	254.4	262.3
1600-1700	<b>242.0</b>	<b>288.0</b>	<b>263.0</b>	279.0	270.0	267.0	256.0	<b>268.4</b>	<b>266.4</b>
1700-1800	224.0	260.0	237.0	248.0	268.0	208.0	178.0	247.4	231.9
1800-1900	125.0	144.0	170.0	171.0	157.0	131.0	78.0	153.4	139.4
1900-2000	64.0	72.0	76.0	95.0	72.0	66.0	34.0	75.8	68.4
2000-2100	36.0	45.0	48.0	56.0	57.0	48.0	28.0	48.4	45.4
2100-2200	21.0	32.0	29.0	42.0	42.0	62.0	13.0	33.2	34.4
2200-2300	18.0	17.0	20.0	25.0	51.0	41.0	7.0	26.2	25.6
2300-2400	3.0	5.0	7.0	13.0	21.0	13.0	3.0	9.8	9.3
<b>Totals</b>									
0700-1900	2264.0	2417.0	*	2540.0	2580.0	2946.0	3486.0	2393.4	2647.0
0600-2200	2480.0	2658.0	*	2813.0	2833.0	3169.0	3619.0	2640.0	2874.0
0600-0000	2501.0	2680.0	*	2851.0	2905.0	3223.0	3629.0	2676.0	2908.9
0000-0000	2550.0	2732.0	*	2910.0	2945.0	3263.0	3679.0	2724.0	2956.0
<b>AM Peak</b>	0800	0800	*	0800	0800	1100	1100		
	213.0	227.0	*	244.0	218.0	363.0	444.0		
<b>PM Peak</b>	1600	1600	1600	1500	1500	1400	1200		
	242.0	288.0	263.0	281.0	288.0	299.0	402.0		

\* - No data.



SpeedHist-72 Page 1



## MetroCount Traffic Executive

### Speed Histogram

#### SpeedHist-72 -- English (ENU)

##### Datasets:

**Site:** [MUNDARING WEIR RD 3] 33 m West of VALLEY RD <60>  
**Attribute:** KALAMUNDA  
**Direction:** 6 - West bound A>B, East bound B>A. **Lane:** 0  
**Survey Duration:** 12:00 Wednesday, May 1, 2019 => 9:00 Wednesday, May 8, 2019,  
**Zone:**  
**File:** MUNDARING WEIR RD 3 0 2019-05-08 0900.EC0 (Plus )  
**Identifier:** JM12PA3T MC56-L5 [MC55] (c)Microcom 19Oct04  
**Algorithm:** Factory default axle (v4.06)  
**Data type:** Axle sensors - Paired (Class/Speed/Count)

##### Profile:

**Filter time:** 12:00 Wednesday, May 1, 2019 => 9:00 Wednesday, May 8, 2019 (6.87502)  
**Included classes:** 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12  
**Speed range:** 10 - 160 km/h.  
**Direction:** North, East, South, West (bound), P = East  
**Separation:** GapX > 0 sec, Span 0 - 100 metre  
**Name:** 60kmh\_roads  
**Scheme:** Vehicle classification (AustRoads94)  
**Units:** Metric (metre, kilometre, m/s, km/h, kg, tonne)  
**In profile:** Vehicles = 20204 / 20235 (99.85%)

#### Speed Statistics

**Direction:** EW  
**Vehicles** = 20204  
**Posted speed limit** = 60 km/h, Exceeding = 7294 (36.10%), Mean Exceeding = 64.94 km/h  
**Maximum** = 133.7 km/h, **Minimum** = 10.3 km/h, **Mean** = 56.2 km/h  
**85% Speed** = 64.4 km/h, **95% Speed** = 69.1 km/h, **Median** = 57.6 km/h  
**20 km/h Pace** = 49 - 69, **Number in Pace** = 15641 (77.42%)  
**Variance** = 99.26, **Standard Deviation** = 9.96 km/h

VirtWeeklyVehicle-1416 Page 1



**MetroCount Traffic Executive**  
**Weekly Vehicle Counts (Virtual Week)**

**VirtWeeklyVehicle-1416 -- English (ENU)**

**Datasets:**

**Site:** [MUNDARING WEIR RD] 500m NW of ALDERSYDE Rd <60>  
**Attribute:** PIESSE BROOK  
**Direction:** 7 - North bound A>B, South bound B>A. **Lane:** 0  
**Survey Duration:** 11:02 Monday, October 19, 2020 => 11:24 Tuesday, October 27, 2020,  
**Zone:**  
**File:** MUNDARING WEIR RD 0 2020-10-27 1124.EC0 (Plus )  
**Identifier:** MK91SQS4 MC56-L5 [MC55] (c)Microcom 19Oct04  
**Algorithm:** Factory default axle (v4.06)  
**Data type:** Axle sensors - Paired (Class/Speed/Count)

**Profile:**

**Filter time:** 11:03 Monday, October 19, 2020 => 11:24 Tuesday, October 27, 2020 (8.01461) (With

Exclusions)

**Exclusion:**

Vehicles are excluded at the following times:

None

The following entire days are excluded:

Friday, October 23, 2020

**Included classes:** 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12  
**Speed range:** 10 - 200 km/h.  
**Direction:** North, East, South, West (bound), P = North  
**Separation:** GapX > 0 sec, Span 0 - 100 metre  
**Name:** 60kmh\_roads  
**Scheme:** Vehicle classification (AustRoads94)  
**Units:** Metric (metre, kilometre, m/s, km/h, kg, tonne)  
**In profile:** Vehicles = 10699 / 11773 (90.88%)



VirtWeeklyVehicle-1416 Page 2

**Weekly Vehicle Counts (Virtual Week)****VirtWeeklyVehicle-1416****Site:** MUNDARING WEIR RD.0.1NS**Description:** 500m NW of ALDERSYDE Rd <60>**Filter time:** 11:03 Monday, October 19, 2020 => 11:24 Tuesday, October 27, 2020 (With Exclusions)**Scheme:** Vehicle classification (AustRoads94)**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,200) GapX(>0) Span(0 - 100)

	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Averages	
								1 - 5	1 - 7
<b>Hour</b>									
0000-0100	2.0	1.0	0.0	2.0	*	6.0	4.0	1.2	2.3
0100-0200	3.0	0.0	2.0	4.0	*	0.0	1.0	1.8	1.4
0200-0300	5.0	1.5	2.0	3.0	*	3.0	1.0	2.6	2.4
0300-0400	7.0	1.5	2.0	2.0	*	3.0	0.0	2.8	2.4
0400-0500	10.0	7.0	4.0	6.0	*	1.0	2.0	6.8	5.3
0500-0600	25.0	23.5	33.0	28.0	*	43.0	34.0	26.6	30.0
0600-0700	79.0	75.5	89.0	78.0	*	102.0	89.0	79.4	84.0
0700-0800	91.0	107.5	114.0	104.0	*	143.0	161.0	104.8	118.3
0800-0900	95.0	98.0	90.0	105.0	*	189.0	190.0	97.2	123.6
0900-1000	99.0	89.0	81.0	86.0	*	233.0	205.0	88.8	126.0
1000-1100	79.0	103.5	94.0	116.0	*	196.0	246.0	99.2	134.0
1100-1200	80.0	63.0	107.0	98.0	*	186.0	222.0	81.8	112.4
1200-1300	79.5	99.0	91.0	87.0	*	160.0	189.0	87.2	112.1
1300-1400	95.5	102.0	85.0	95.0	*	160.0	144.0	94.6	111.0
1400-1500	104.0	107.0	117.0	130.0	*	151.0	152.0	112.4	123.6
1500-1600	117.0	123.0	145.0	136.0	*	107.0	90.0	127.6	119.3
1600-1700	100.5	93.0	115.0	133.0	*	102.0	77.0	108.4	103.0
1700-1800	72.5	81.0	98.0	131.0	*	85.0	68.0	91.0	86.9
1800-1900	47.0	33.0	67.0	55.0	*	52.0	36.0	49.8	48.1
1900-2000	18.5	25.0	41.0	36.0	*	33.0	18.0	27.8	27.1
2000-2100	15.5	17.0	24.0	32.0	*	20.0	11.0	20.8	19.3
2100-2200	8.0	5.0	11.0	27.0	*	13.0	9.0	11.8	11.6
2200-2300	4.0	1.0	1.0	5.0	*	8.0	8.0	3.0	4.4
2300-2400	1.0	0.0	0.0	6.0	*	17.0	2.0	1.6	3.9
<b>Totals</b>									
0700-1900	1060.0	1099.0	1204.0	1276.0	*	1764.0	1780.0	1142.8	1318.2
0600-2200	1181.0	1221.5	1369.0	1449.0	*	1932.0	1907.0	1282.6	1460.2
0600-0000	1186.0	1222.5	1370.0	1460.0	*	1957.0	1917.0	1287.2	1468.5
0000-0000	1238.0	1257.0	1413.0	1505.0	*	2013.0	1959.0	1329.0	1512.4
<b>AM Peak</b>	0900	0700	0700	1000	*	0900	1000		
	99.0	107.5	114.0	116.0	*	233.0	246.0		
<b>PM Peak</b>	1500	1500	1500	1500	*	1300	1200		
	117.0	123.0	145.0	136.0	*	160.0	189.0		

\* - No data.

SpeedHist-1418 Page 1



## **MetroCount Traffic Executive Speed Histogram**

### **SpeedHist-1418 -- English (ENU)**

#### **Datasets:**

**Site:** [MUNDARING WEIR RD] 500m NW of ALDERSYDE Rd <60>  
**Attribute:** PIESSE BROOK  
**Direction:** 7 - North bound A>B, South bound B>A. **Lane:** 0  
**Survey Duration:** 11:02 Monday, October 19, 2020 => 11:24 Tuesday, October 27, 2020,  
**Zone:**  
**File:** MUNDARING WEIR RD 0 2020-10-27 1124.EC0 (Plus )  
**Identifier:** MK91SQS4 MC56-L5 [MC55] (c)Microcom 19Oct04  
**Algorithm:** Factory default axle (v4.06)  
**Data type:** Axle sensors - Paired (Class/Speed/Count)

#### **Profile:**

**Filter time:** 11:03 Monday, October 19, 2020 => 11:24 Tuesday, October 27, 2020 (8.01461) (With  
 Exclusions)

#### **Exclusion:**

Vehicles are excluded at the following times:  
 None  
 The following entire days are excluded:  
 Friday, October 23, 2020

**Included classes:** 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12  
**Speed range:** 10 - 200 km/h.  
**Direction:** North, East, South, West (bound), P = North  
**Separation:** GapX > 0 sec, Span 0 - 100 metre  
**Name:** 60kmh\_roads  
**Scheme:** Vehicle classification (AustRoads94)  
**Units:** Metric (metre, kilometre, m/s, km/h, kg, tonne)  
**In profile:** Vehicles = 10699 / 11773 (90.88%)

### **Speed Statistics**

**Direction:** NS  
**Vehicles** = 10699  
**Posted speed limit** = 60 km/h, Exceeding = 4799 (44.85%), Mean Exceeding = 65.50 km/h  
**Maximum** = 107.1 km/h, **Minimum** = 10.4 km/h, **Mean** = 58.6 km/h  
**85% Speed** = 65.9 km/h, **95% Speed** = 71.3 km/h, **Median** = 59.0 km/h  
**20 km/h Pace** = 49 - 69, **Number in Pace** = 8950 (83.65%)  
**Variance** = 96.32, **Standard Deviation** = 9.81 km/h



VirtWeeklyVehicle-1198 Page 1



**MetroCount Traffic Executive**  
**Weekly Vehicle Counts (Virtual Week)**

**VirtWeeklyVehicle-1198 -- English (ENU)**

**Datasets:**

**Site:** [MUNDARING W RD 2] 40m West of FERN RD <60>  
**Attribute:** PIESSE BROOK  
**Direction:** 6 - West bound A>B, East bound B>A. Lane: 0  
**Survey Duration:** 10:42 Tuesday, June 9, 2020 => 9:22 Tuesday, June 16, 2020,  
**Zone:**  
**File:** MUNDARING W RD 2 0 2020-06-16 0923.EC0 (Plus )  
**Identifier:** AC73KEVC MC56-L5 [MC55] (c)Microcom 19Oct04  
**Algorithm:** Factory default axle (v4.06)  
**Data type:** Axle sensors - Paired (Class/Speed/Count)

**Profile:**

**Filter time:** 10:43 Tuesday, June 9, 2020 => 9:22 Tuesday, June 16, 2020 (6.94405)  
**Included classes:** 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12  
**Speed range:** 10 - 160 km/h.  
**Direction:** North, East, South, West (bound), P = East  
**Separation:** GapX > 0 sec, Span 0 - 100 metre  
**Name:** 60kmh\_roads  
**Scheme:** Vehicle classification (AustRoads94)  
**Units:** Metric (metre, kilometre, m/s, km/h, kg, tonne)  
**In profile:** Vehicles = 11496 / 11516 (99.83%)

VirtWeeklyVehicle-1198 Page 2

**Weekly Vehicle Counts (Virtual Week)****VirtWeeklyVehicle-1198****Site:** MUNDARING W RD 2.0.1WE**Description:** 40m West of FERN RD <60>**Filter time:** 10:43 Tuesday, June 9, 2020 => 9:22 Tuesday, June 16, 2020**Scheme:** Vehicle classification (AustRoads94)**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) GapX(>0) Span(0 - 100)

	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Averages	
								1 - 5	1 - 7
<b>Hour</b>									
0000-0100	5.0	0.0	1.0	0.0	0.0	4.0	5.0	1.2	2.1
0100-0200	2.0	1.0	1.0	3.0	2.0	2.0	1.0	1.8	1.7
0200-0300	0.0	0.0	4.0	2.0	0.0	4.0	3.0	1.2	1.9
0300-0400	2.0	0.0	1.0	0.0	2.0	1.0	1.0	1.0	1.0
0400-0500	5.0	3.0	2.0	1.0	2.0	0.0	0.0	2.6	1.9
0500-0600	19.0	16.0	18.0	13.0	13.0	6.0	5.0	15.8	12.9
0600-0700	41.0	43.0	45.0	40.0	34.0	45.0	45.0	40.6	41.9
0700-0800	98.0	103.0	99.0	89.0	89.0	134.0	132.0	95.6	106.3
0800-0900	104.0	97.0	111.0	83.0	94.0	148.0	153.0	97.8	112.9
0900-1000	79.0	33.0	113.0	60.0	58.0	206.0	261.0	68.6	115.7
1000-1100	78.0	27.0	100.0	59.0	79.0	234.0	290.0	68.6	123.9
1100-1200	84.0	123.0	121.0	75.0	81.0	226.0	354.0	96.8	152.0
1200-1300	88.0	124.0	140.0	72.0	95.0	220.0	320.0	103.8	151.3
1300-1400	94.0	118.0	98.0	88.0	106.0	233.0	331.0	100.8	152.6
1400-1500	89.0	138.0	125.0	87.0	113.0	213.0	307.0	110.4	153.1
1500-1600	124.0	136.0	150.0	114.0	120.0	184.0	266.0	128.8	156.3
1600-1700	138.0	146.0	171.0	151.0	130.0	148.0	169.0	147.2	150.4
1700-1800	71.0	95.0	129.0	110.0	111.0	90.0	123.0	103.2	104.1
1800-1900	34.0	34.0	50.0	52.0	38.0	32.0	30.0	41.6	38.6
1900-2000	16.0	15.0	28.0	13.0	29.0	20.0	10.0	20.2	18.7
2000-2100	13.0	18.0	25.0	21.0	21.0	15.0	11.0	19.6	17.7
2100-2200	8.0	12.0	12.0	19.0	19.0	17.0	6.0	14.0	13.3
2200-2300	1.0	2.0	6.0	11.0	12.0	11.0	4.0	6.4	6.7
2300-2400	1.0	6.0	1.0	4.0	6.0	18.0	2.0	3.6	5.4
<b>Totals</b>									
0700-1900	1081.0	1174.0	1407.0	1040.0	1114.0	2068.0	2736.0	1163.2	1517.1
0600-2200	1159.0	1262.0	1517.0	1133.0	1217.0	2165.0	2808.0	1257.6	1608.7
0600-0000	1161.0	1270.0	1524.0	1148.0	1235.0	2194.0	2814.0	1267.6	1620.9
0000-0000	1194.0	1290.0	1551.0	1167.0	1254.0	2211.0	2829.0	1291.2	1642.3
<b>AM Peak</b>	0800	1100	1100	0700	0800	1000	1100		
	104.0	123.0	121.0	89.0	94.0	234.0	354.0		
<b>PM Peak</b>	1600	1600	1600	1600	1600	1300	1300		
	138.0	146.0	171.0	151.0	130.0	233.0	331.0		

\* - No data.





## **MetroCount Traffic Executive Speed Histogram**

### **SpeedHist-1200 -- English (ENU)**

#### **Datasets:**

**Site:** [MUNDARING W RD 2] 40m West of FERN RD <60>  
**Attribute:** PIESSE BROOK  
**Direction:** 6 - West bound A>B, East bound B>A. **Lane:** 0  
**Survey Duration:** 10:42 Tuesday, June 9, 2020 => 9:22 Tuesday, June 16, 2020,  
**Zone:**  
**File:** MUNDARING W RD 2 0 2020-06-16 0923.EC0 (Plus )  
**Identifier:** AC73KEVC MC56-L5 [MC55] (c)Microcom 19Oct04  
**Algorithm:** Factory default axle (v4.06)  
**Data type:** Axle sensors - Paired (Class/Speed/Count)

#### **Profile:**

**Filter time:** 10:43 Tuesday, June 9, 2020 => 9:22 Tuesday, June 16, 2020 (6.94405)  
**Included classes:** 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12  
**Speed range:** 10 - 160 km/h.  
**Direction:** North, East, South, West (bound), P = East  
**Separation:** GapX > 0 sec, Span 0 - 100 metre  
**Name:** 60kmh\_roads  
**Scheme:** Vehicle classification (AustRoads94)  
**Units:** Metric (metre, kilometre, m/s, km/h, kg, tonne)  
**In profile:** Vehicles = 11496 / 11516 (99.83%)

#### **Speed Statistics**

**Direction:** EW  
**Vehicles** = 11496  
**Posted speed limit** = 60 km/h, Exceeding = 3489 (30.35%), Mean Exceeding = 64.54 km/h  
**Maximum** = 112.9 km/h, **Minimum** = 13.1 km/h, **Mean** = 56.0 km/h  
**85% Speed** = 63.4 km/h, **95% Speed** = 67.7 km/h, **Median** = 56.5 km/h  
**20 km/h Pace** = 47 - 67, **Number in Pace** = 9472 (82.39%)  
**Variance** = 71.98, **Standard Deviation** = 8.48 km/h

VirtWeeklyVehicle-1201 Page 1



**MetroCount Traffic Executive**  
**Weekly Vehicle Counts (Virtual Week)**

**VirtWeeklyVehicle-1201 -- English (ENU)**

**Datasets:**

**Site:** [MUNDARING W RD 1] 200m East of FERN RD <60>  
**Attribute:** PIESSE BROOK  
**Direction:** 6 - West bound A>B, East bound B>A. **Lane:** 0  
**Survey Duration:** 10:59 Tuesday, June 9, 2020 => 9:30 Tuesday, June 16, 2020,  
**Zone:**  
**File:** MUNDARING W RD 1 0 2020-06-16 0930.EC0 (Plus )  
**Identifier:** EA45EKEW MC56-L5 [MC55] (c)Microcom 19Oct04  
**Algorithm:** Factory default axle (v4.06)  
**Data type:** Axle sensors - Paired (Class/Speed/Count)

**Profile:**

**Filter time:** 11:00 Tuesday, June 9, 2020 => 9:30 Tuesday, June 16, 2020 (6.93752)  
**Included classes:** 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12  
**Speed range:** 10 - 160 km/h.  
**Direction:** North, East, South, West (bound), P = East  
**Separation:** GapX > 0 sec, Span 0 - 100 metre  
**Name:** 60kmh\_roads  
**Scheme:** Vehicle classification (AustRoads94)  
**Units:** Metric (metre, kilometre, m/s, km/h, kg, tonne)  
**In profile:** Vehicles = 10708 / 10714 (99.94%)



VirtWeeklyVehicle-1201 Page 2

**Weekly Vehicle Counts (Virtual Week)****VirtWeeklyVehicle-1201****Site:** MUNDARING W RD 1.0.1WE**Description:** 200m East of FERN RD <60>**Filter time:** 11:00 Tuesday, June 9, 2020 => 9:30 Tuesday, June 16, 2020**Scheme:** Vehicle classification (AustRoads94)**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) GapX(>0) Span(0 - 100)

	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Averages	
								1 - 5	1 - 7
<b>Hour</b>									
0000-0100	5.0	0.0	1.0	0.0	0.0	4.0	4.0	1.2	2.0
0100-0200	2.0	1.0	1.0	3.0	2.0	2.0	1.0	1.8	1.7
0200-0300	0.0	0.0	4.0	2.0	0.0	4.0	2.0	1.2	1.7
0300-0400	1.0	0.0	1.0	0.0	0.0	1.0	1.0	0.4	0.6
0400-0500	5.0	3.0	1.0	1.0	1.0	0.0	0.0	2.2	1.6
0500-0600	13.0	14.0	14.0	10.0	11.0	5.0	2.0	12.4	9.9
0600-0700	37.0	38.0	39.0	35.0	33.0	41.0	44.0	36.4	38.1
0700-0800	92.0	100.0	90.0	85.0	89.0	133.0	125.0	91.2	102.0
0800-0900	91.0	89.0	100.0	70.0	84.0	139.0	138.0	86.8	101.6
0900-1000	73.0	40.0	104.0	61.0	51.0	200.0	248.0	65.8	111.0
1000-1100	72.0	*	91.0	54.0	75.0	217.0	273.0	73.0	130.3
1100-1200	77.0	108.0	115.0	69.0	75.0	219.0	339.0	88.8	143.1
1200-1300	76.0	116.0	132.0	66.0	89.0	209.0	306.0	95.8	142.0
1300-1400	88.0	111.0	94.0	81.0	99.0	221.0	321.0	94.6	145.0
1400-1500	80.0	128.0	121.0	74.0	101.0	206.0	300.0	100.8	144.3
1500-1600	116.0	128.0	134.0	98.0	107.0	180.0	258.0	116.6	145.9
1600-1700	132.0	140.0	157.0	145.0	118.0	140.0	163.0	138.4	142.1
1700-1800	65.0	81.0	125.0	102.0	101.0	80.0	113.0	94.8	95.3
1800-1900	28.0	31.0	44.0	47.0	38.0	32.0	26.0	37.6	35.1
1900-2000	13.0	12.0	22.0	13.0	24.0	16.0	10.0	16.8	15.7
2000-2100	13.0	15.0	21.0	20.0	17.0	15.0	10.0	17.2	15.9
2100-2200	8.0	11.0	12.0	17.0	19.0	17.0	5.0	13.4	12.7
2200-2300	1.0	1.0	6.0	10.0	11.0	10.0	4.0	5.8	6.1
2300-2400	1.0	6.0	1.0	4.0	6.0	12.0	2.0	3.6	4.6
<b>Totals</b>									
0700-1900	990.0	*	1307.0	952.0	1027.0	1976.0	2610.0	1084.2	1437.8
0600-2200	1061.0	*	1401.0	1037.0	1120.0	2065.0	2679.0	1168.0	1520.2
0600-0000	1063.0	*	1408.0	1051.0	1137.0	2087.0	2685.0	1177.4	1530.9
0000-0000	1089.0	*	1430.0	1067.0	1151.0	2103.0	2695.0	1196.6	1548.3
<b>AM Peak</b>	0700	*	1100	0700	0700	1100	1100		
	92.0	*	115.0	85.0	89.0	219.0	339.0		
<b>PM Peak</b>	1600	1600	1600	1600	1600	1300	1300		
	132.0	140.0	157.0	145.0	118.0	221.0	321.0		

\* - No data.



## **MetroCount Traffic Executive Speed Histogram**

### **SpeedHist-1203 -- English (ENU)**

#### **Datasets:**

**Site:** [MUNDARING W RD 1] 200m East of FERN RD <60>  
**Attribute:** PIESSE BROOK  
**Direction:** 6 - West bound A>B, East bound B>A. **Lane:** 0  
**Survey Duration:** 10:59 Tuesday, June 9, 2020 => 9:30 Tuesday, June 16, 2020,  
**Zone:**  
**File:** MUNDARING W RD 1 0 2020-06-16 0930.EC0 (Plus )  
**Identifier:** EA45EKEW MC56-L5 [MC55] (c)Microcom 19Oct04  
**Algorithm:** Factory default axle (v4.06)  
**Data type:** Axle sensors - Paired (Class/Speed/Count)

#### **Profile:**

**Filter time:** 11:00 Tuesday, June 9, 2020 => 9:30 Tuesday, June 16, 2020 (6.93752)  
**Included classes:** 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12  
**Speed range:** 10 - 160 km/h.  
**Direction:** North, East, South, West (bound), P = East  
**Separation:** GapX > 0 sec, Span 0 - 100 metre  
**Name:** 60kmh\_roads  
**Scheme:** Vehicle classification (AustRoads94)  
**Units:** Metric (metre, kilometre, m/s, km/h, kg, tonne)  
**In profile:** Vehicles = 10708 / 10714 (99.94%)

#### **Speed Statistics**

**Direction:** EW  
**Vehicles** = 10708  
**Posted speed limit** = 60 km/h, Exceeding = 9158 (85.52%), Mean Exceeding = 70.58 km/h  
**Maximum** = 146.1 km/h, **Minimum** = 16.2 km/h, **Mean** = 68.4 km/h  
**85% Speed** = 76.3 km/h, **95% Speed** = 82.8 km/h, **Median** = 67.7 km/h  
**20 km/h Pace** = 58 - 78, **Number in Pace** = 8494 (79.32%)  
**Variance** = 80.34, **Standard Deviation** = 8.96 km/h



VirtWeeklyVehicle-1193 Page 1



**MetroCount Traffic Executive**  
**Weekly Vehicle Counts (Virtual Week)**

**VirtWeeklyVehicle-1193 -- English (ENU)**

**Datasets:**

**Site:** [MUNDARING W RD 3] Near House Number #370 <60>  
**Attribute:** PIESSE BROOK  
**Direction:** 7 - North bound A>B, South bound B>A. **Lane:** 0  
**Survey Duration:** 10:27 Tuesday, June 9, 2020 => 9:18 Tuesday, June 16, 2020,  
**Zone:**  
**File:** MUNDARING W RD 3 0 2020-06-16 0918.EC0 (Plus )  
**Identifier:** MK91SQS4 MC56-L5 [MC55] (c)Microcom 19Oct04  
**Algorithm:** Factory default axle (v4.06)  
**Data type:** Axle sensors - Paired (Class/Speed/Count)

**Profile:**

**Filter time:** 10:28 Tuesday, June 9, 2020 => 9:18 Tuesday, June 16, 2020 (6.95177)  
**Included classes:** 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12  
**Speed range:** 10 - 160 km/h.  
**Direction:** North, East, South, West (bound), P = North  
**Separation:** GapX > 0 sec, Span 0 - 100 metre  
**Name:** 60kmh\_roads  
**Scheme:** Vehicle classification (AustRoads94)  
**Units:** Metric (metre, kilometre, m/s, km/h, kg, tonne)  
**In profile:** Vehicles = 11734 / 11747 (99.89%)

VirtWeeklyVehicle-1193 Page 2

**Weekly Vehicle Counts (Virtual Week)****VirtWeeklyVehicle-1193****Site:** MUNDARING W RD 3.0.1NS**Description:** Near House Number #370 <60>**Filter time:** 10:28 Tuesday, June 9, 2020 => 9:18 Tuesday, June 16, 2020**Scheme:** Vehicle classification (AustRoads94)**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) GapX(>0) Span(0 - 100)

	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Averages	
								1 - 5	1 - 7
<b>Hour</b>									
0000-0100	5.0	0.0	1.0	0.0	0.0	4.0	5.0	1.2	2.1
0100-0200	2.0	1.0	1.0	3.0	2.0	2.0	2.0	1.8	1.9
0200-0300	0.0	0.0	4.0	2.0	0.0	4.0	2.0	1.2	1.7
0300-0400	2.0	1.0	1.0	0.0	2.0	1.0	1.0	1.2	1.1
0400-0500	5.0	2.0	2.0	1.0	2.0	0.0	0.0	2.4	1.7
0500-0600	19.0	16.0	18.0	13.0	13.0	6.0	6.0	15.8	13.0
0600-0700	42.0	45.0	46.0	41.0	37.0	47.0	48.0	42.2	43.7
0700-0800	96.0	103.0	100.0	88.0	97.0	139.0	131.0	96.8	107.7
0800-0900	<b>109.0</b>	102.0	115.0	<b>89.0</b>	<b>100.0</b>	144.0	151.0	<b>103.0</b>	115.7
0900-1000	83.0	20.0	116.0	65.0	58.0	208.0	265.0	68.4	116.4
1000-1100	74.0	50.0	100.0	59.0	83.0	<b>242.0</b>	292.0	73.2	128.6
1100-1200	91.0	<b>127.0</b>	<b>121.0</b>	77.0	83.0	224.0	<b>346.0</b>	99.8	<b>152.7</b>
1200-1300	94.0	130.0	137.0	76.0	98.0	222.0	331.0	107.0	155.4
1300-1400	105.0	121.0	109.0	91.0	110.0	<b>231.0</b>	<b>337.0</b>	107.2	157.7
1400-1500	89.0	138.0	129.0	89.0	111.0	214.0	310.0	111.2	154.3
1500-1600	128.0	142.0	157.0	116.0	117.0	190.0	273.0	132.0	<b>160.4</b>
1600-1700	<b>141.0</b>	<b>143.0</b>	<b>170.0</b>	<b>153.0</b>	<b>136.0</b>	149.0	167.0	<b>148.6</b>	151.3
1700-1800	74.0	99.0	130.0	110.0	111.0	94.0	128.0	104.8	106.6
1800-1900	37.0	34.0	48.0	53.0	40.0	33.0	31.0	42.4	39.4
1900-2000	17.0	15.0	29.0	14.0	32.0	24.0	13.0	21.4	20.6
2000-2100	13.0	18.0	26.0	22.0	21.0	13.0	11.0	20.0	17.7
2100-2200	9.0	12.0	13.0	18.0	18.0	18.0	6.0	14.0	13.4
2200-2300	1.0	2.0	5.0	13.0	13.0	13.0	4.0	6.8	7.3
2300-2400	1.0	6.0	1.0	3.0	6.0	21.0	2.0	3.4	5.7
<b>Totals</b>									
0700-1900	1121.0	1209.0	1432.0	1066.0	1144.0	2090.0	2762.0	1194.4	1546.3
0600-2200	1202.0	1299.0	1546.0	1161.0	1252.0	2192.0	2840.0	1292.0	1641.7
0600-0000	1204.0	1307.0	1552.0	1177.0	1271.0	2226.0	2846.0	1302.2	1654.7
0000-0000	1237.0	1327.0	1579.0	1196.0	1290.0	2243.0	2862.0	1325.8	1676.3
<b>AM Peak</b>	0800	1100	1100	0800	0800	1000	1100		
	109.0	127.0	121.0	89.0	100.0	242.0	346.0		
<b>PM Peak</b>	1600	1600	1600	1600	1600	1300	1300		
	141.0	143.0	170.0	153.0	136.0	231.0	337.0		

\* - No data.



SpeedHist-1195 Page 1



## **MetroCount Traffic Executive Speed Histogram**

### **SpeedHist-1195 -- English (ENU)**

#### **Datasets:**

**Site:** [MUNDARING W RD 3] Near House Number #370 <60>  
**Attribute:** PIESSE BROOK  
**Direction:** 7 - North bound A>B, South bound B>A. **Lane:** 0  
**Survey Duration:** 10:27 Tuesday, June 9, 2020 => 9:18 Tuesday, June 16, 2020,  
**Zone:**  
**File:** MUNDARING W RD 3 0 2020-06-16 0918.EC0 (Plus )  
**Identifier:** MK91SQS4 MC56-L5 [MC55] (c)Microcom 19Oct04  
**Algorithm:** Factory default axle (v4.06)  
**Data type:** Axle sensors - Paired (Class/Speed/Count)

#### **Profile:**

**Filter time:** 10:28 Tuesday, June 9, 2020 => 9:18 Tuesday, June 16, 2020 (6.95177)  
**Included classes:** 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12  
**Speed range:** 10 - 160 km/h.  
**Direction:** North, East, South, West (bound), P = North  
**Separation:** GapX > 0 sec, Span 0 - 100 metre  
**Name:** 60kmh\_roads  
**Scheme:** Vehicle classification (AustRoads94)  
**Units:** Metric (metre, kilometre, m/s, km/h, kg, tonne)  
**In profile:** Vehicles = 11734 / 11747 (99.89%)

#### **Speed Statistics**

**Direction:** NS  
**Vehicles** = 11734  
**Posted speed limit** = 60 km/h, Exceeding = 5712 (48.68%), Mean Exceeding = 65.38 km/h  
**Maximum** = 105.3 km/h, **Minimum** = 10.9 km/h, **Mean** = 59.6 km/h  
**85% Speed** = 66.2 km/h, **95% Speed** = 71.3 km/h, **Median** = 59.8 km/h  
**20 km/h Pace** = 50 - 70, **Number in Pace** = 10089 (85.98%)  
**Variance** = 61.43, **Standard Deviation** = 7.84 km/h

Client: City of Kalamunda

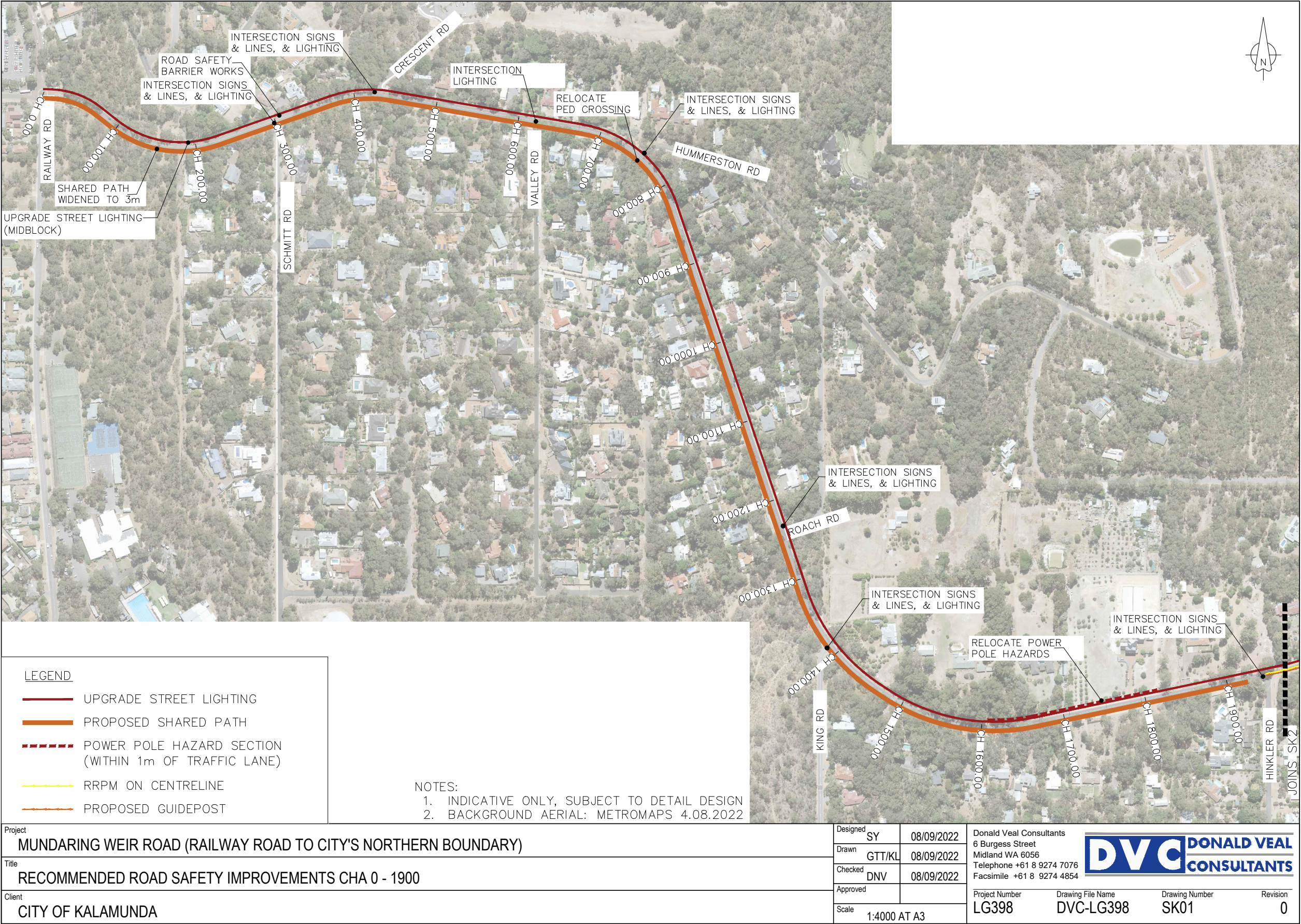
Project: Mundaring Weir Rd - Road Safety Investigation

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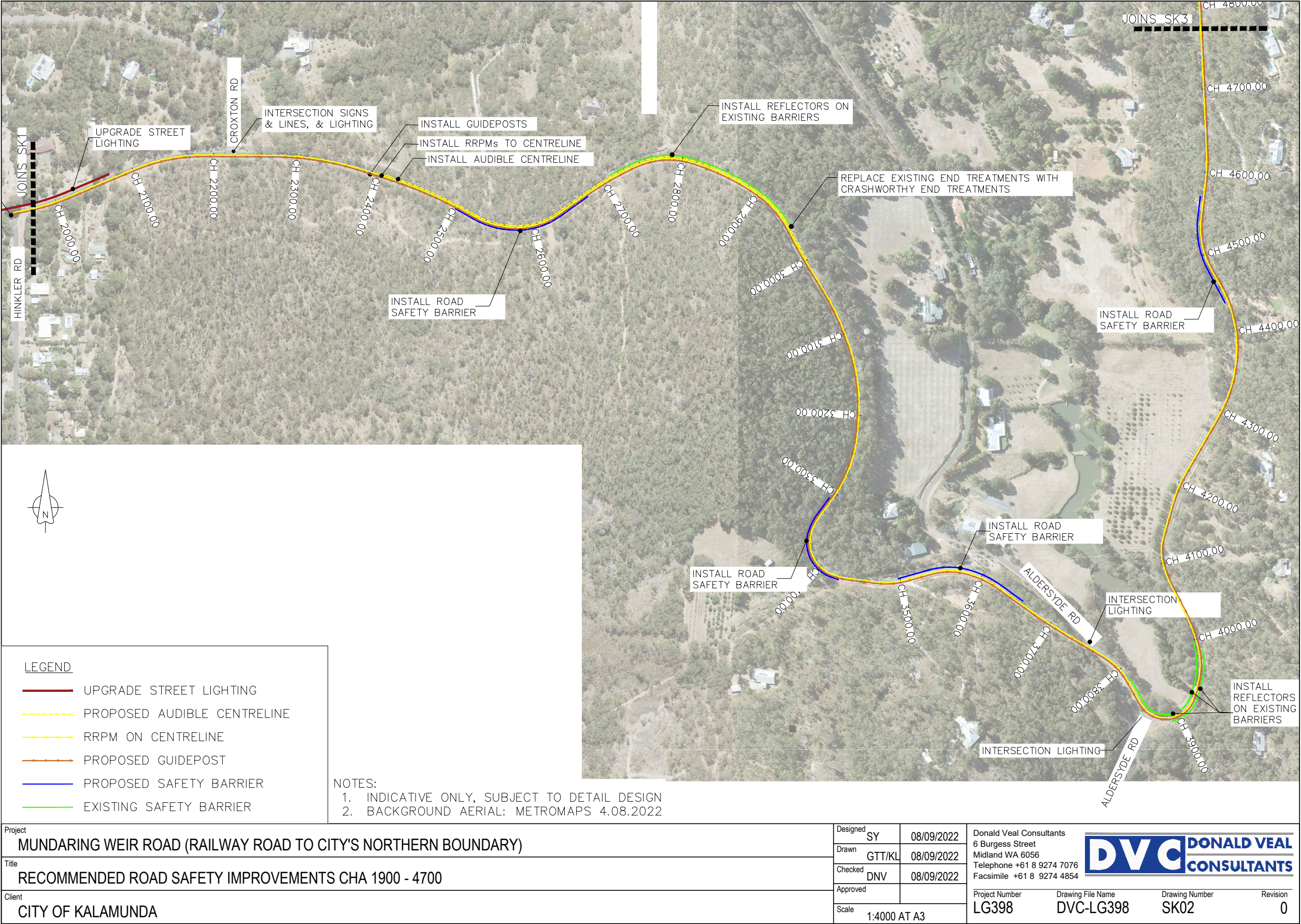


## **APPENDIX B: RECOMMENDED IMPROVEMENTS**

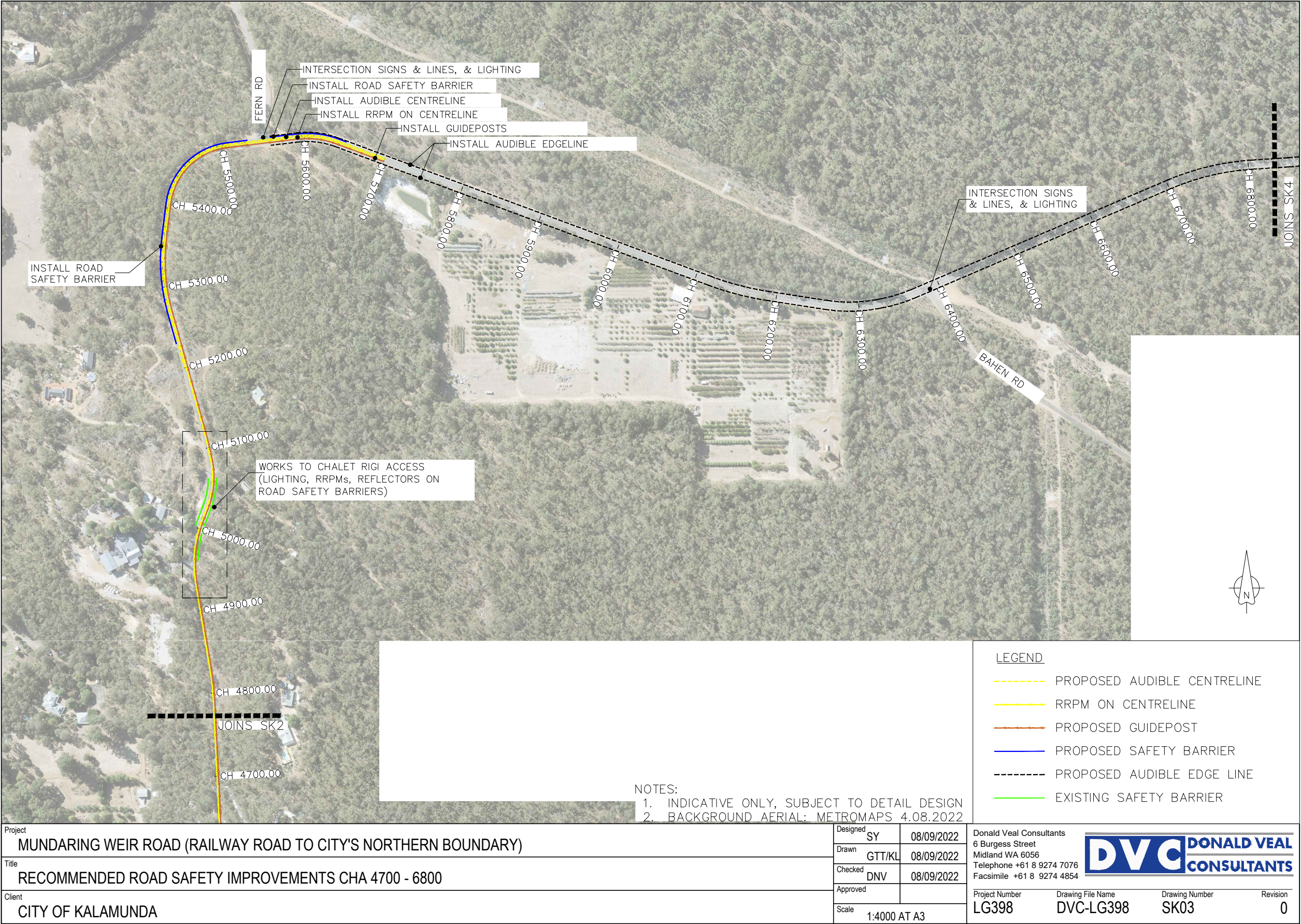




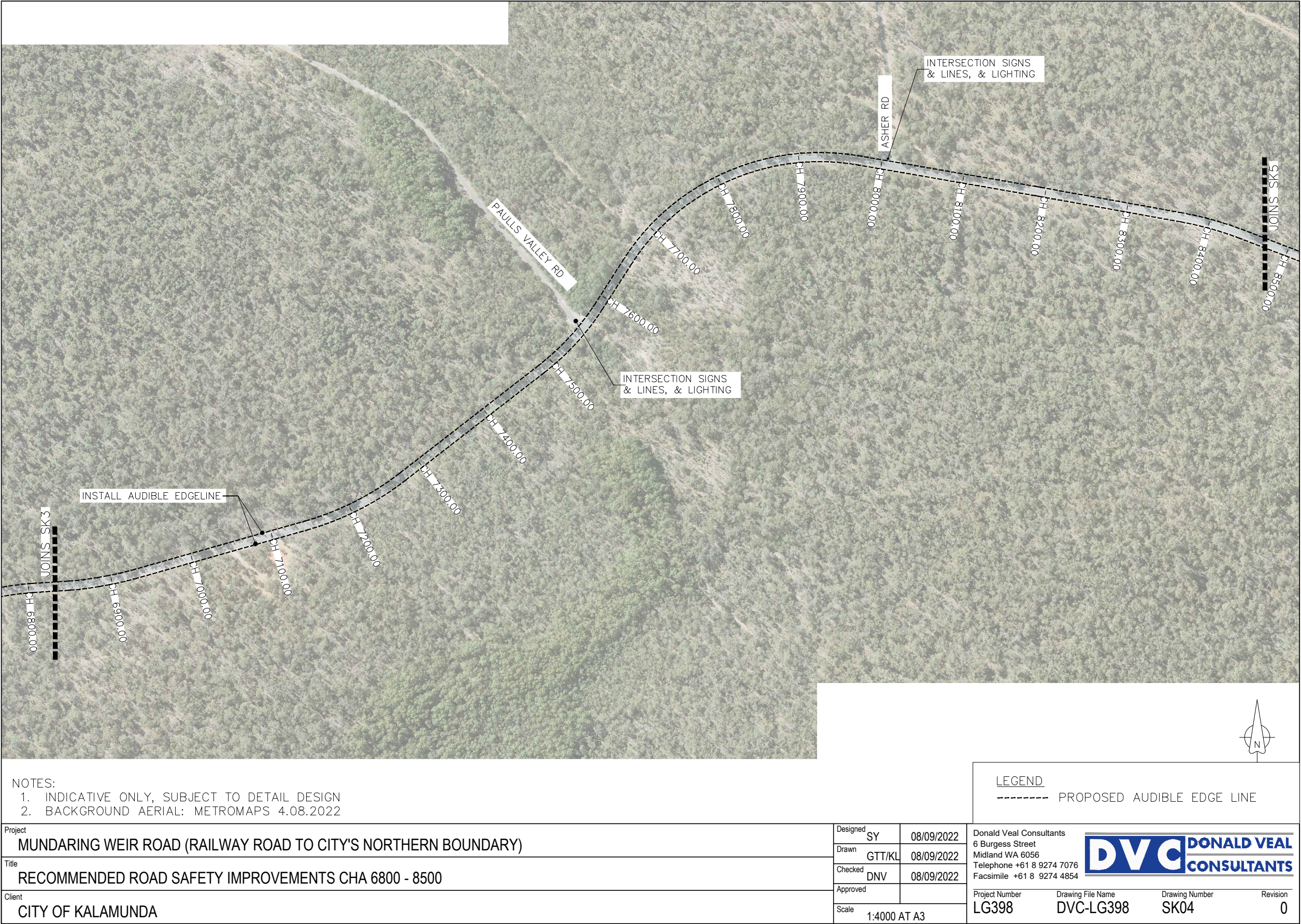




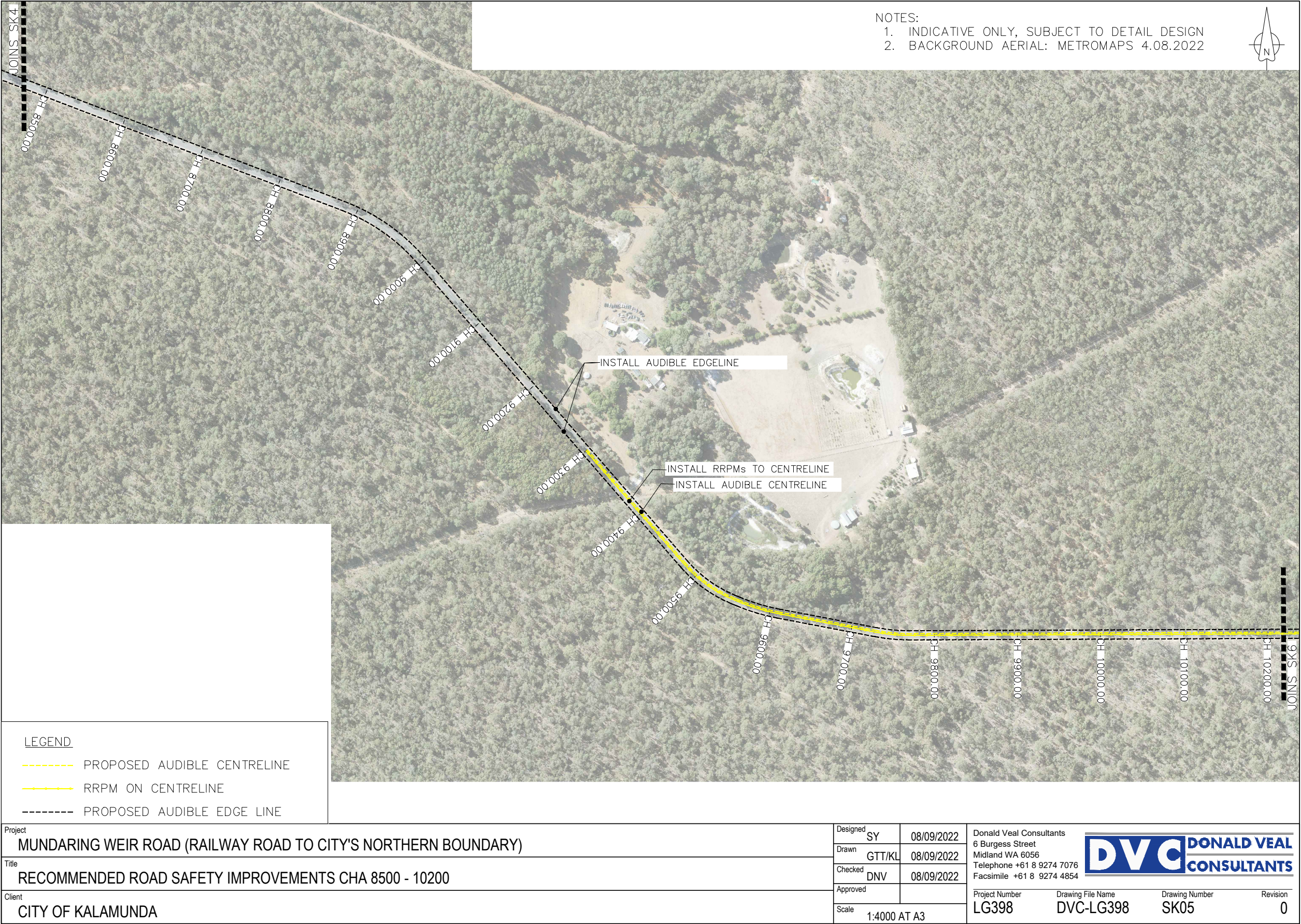




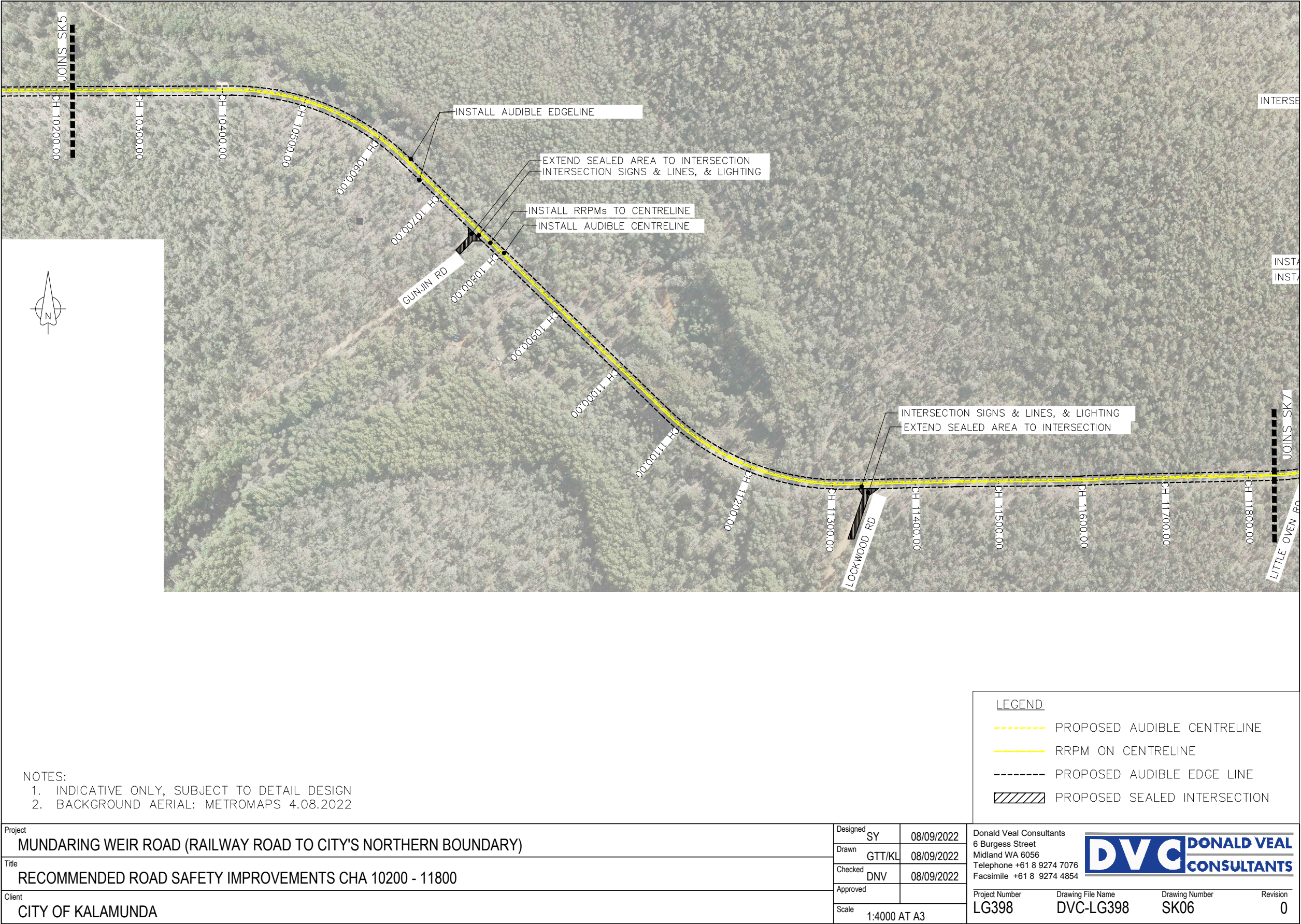




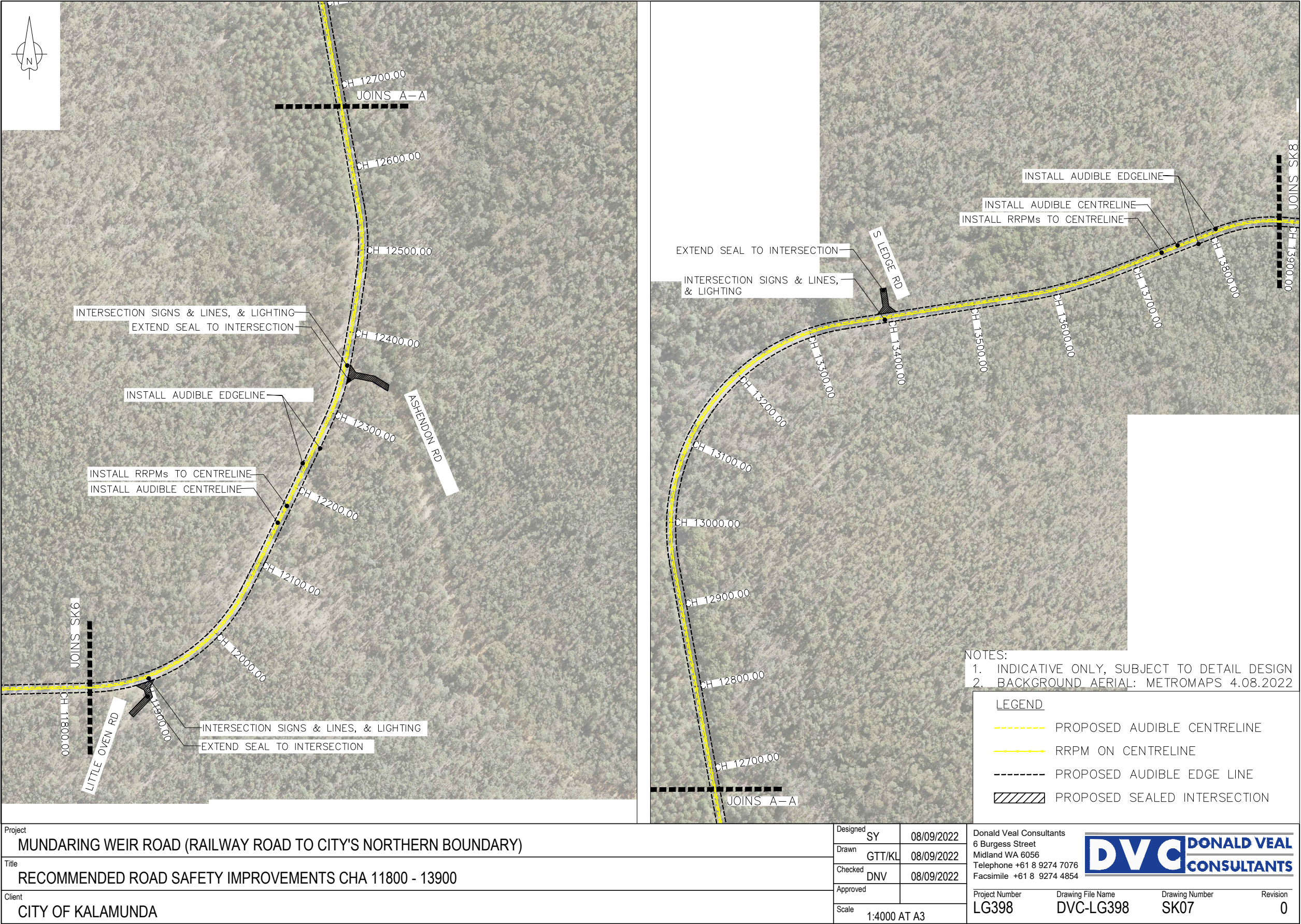




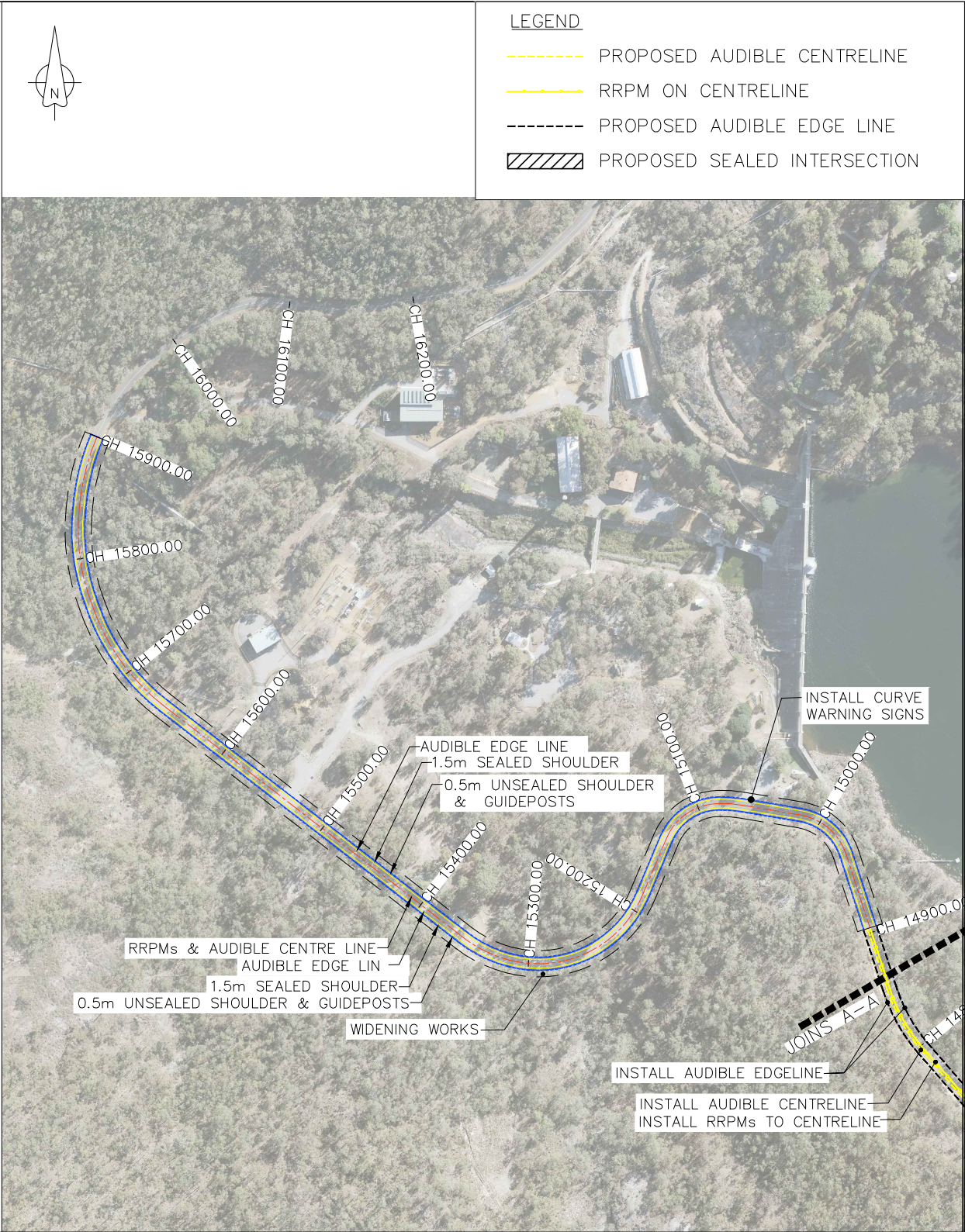
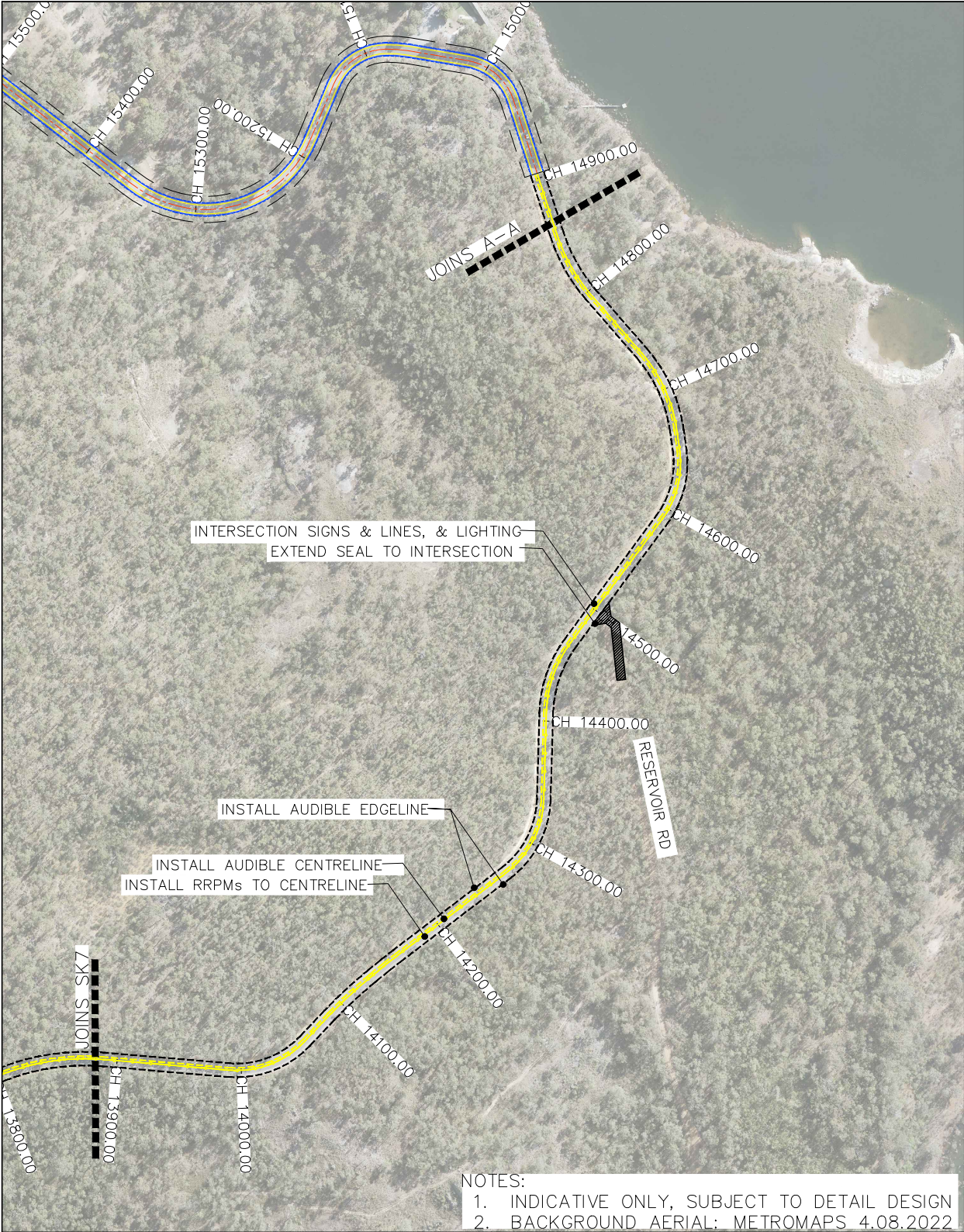












Project MUNDARING WEIR ROAD (RAILWAY ROAD TO CITY'S NORTHERN BOUNDARY)		Designed SY	08/09/2022	Donald Veal Consultants 6 Burgess Street Midland WA 6056 Telephone +61 8 9274 7076 Facsimile +61 8 9274 4854			
Title RECOMMENDED ROAD SAFETY IMPROVEMENTS CHA 13900 - 15900		Drawn GTT/KL	08/09/2022				
Client CITY OF KALAMUNDA		Checked DNV	08/09/2022				
		Approved					
		Scale 1:4000 AT A3		Project Number LG398	Drawing File Name DVC-LG398	Drawing Number SK08	Revision 0